

THE IMPACT OF HEALTH LITERACY, CULTURE AND PSYCHOSOCIAL FACTORS ON
THE PAP TESTING BEHAVIORS OF AFRICAN IMMIGRANT WOMEN IN THE UNITED
STATES

by
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Abstract

Background: African immigrant (AI) women have low Pap testing rates. Limited health literacy is a barrier to cancer screening among racial/ethnic minority populations. Sources and types of health information can shape health literacy. However, how health literacy, sources and types of health information along with cultural and psychosocial correlates impact the Pap testing behaviors of AI women remains unknown.

Objective: To examine how sources and types of health information impact health literacy and health information exchange, and in turn, how health literacy, culture and psychosocial (cancer knowledge, self-efficacy, decisional balance, cultural beliefs) factors influence the Pap testing behaviors of AI women.

Methods: Using an explanatory mixed-methods approach, a convenience sample of AI women (N=167) completed study surveys followed by semi-structured, telephone interviews with a purposive sub-sample (n=20) of survey participants. An adapted Health Literacy Skills (HLS) conceptual framework guided the selection of study variables. Qualitative and quantitative data were merged to describe differences and similarities in AI women's experiences and display of health literacy by different sources and types of health information.

Results: Using multiple sources of health information (adjusted OR [aOR]: 0.11, $p<0.01$), having negative cultural beliefs (aOR: 0.17, $p=0.01$) and high self-efficacy (aOR: 9.38, $p<0.01$) were significantly associated with Pap testing. Healthcare providers (78%), female friends (46%) and internet (45%) were the most common sources of health information used by AI women followed by female relatives (32%), television (22%), social media (17%) and church (16%). Content analysis revealed: Healthcare provider was rated the most credible source; family/friends personal experiences made health information more relatable; church as the least endorsed source. Health information presented verbally (aOR: 5.51, $p=0.01$) was associated with higher

health literacy. Most AI women had health information presented in verbal form (80%), with pictures (43%) being the least popular type of health information.

Conclusion: Cultural beliefs play a significant role in shaping AI women's Pap testing behaviors. Exchanging health information in verbal form could shape health literacy and inform Pap testing among AI women. Using the internet to recruit study participants appears to be a promising strategy to consider for future studies that include African immigrants.

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CHAPTER 1

Background

Cervical cancer is the leading cause of cancer related death worldwide but particularly in sub-Saharan Africa, with 70,000 new cases detected each year, and a high percentage remaining undiagnosed.¹ It is estimated that in 2019, 13,170 new cases of cervical cancer will be diagnosed in the U.S., and about 4,250 deaths will be reported.² The introduction of the Papanicolaou (Pap) test, a low-cost early detection procedure, has significantly decreased the incidence of cervical cancer in the US.² However, African immigrant (AI) women, of which over 700,000 reside in the US,³ are disproportionately burdened by this disease: African immigrant women often present to the hospital for treatment with later, metastatic stage cervical cancer,⁴⁻⁸ when chances of survival has dramatically decreased from 95% to less than 17%.^{2,9,10} Worse cancer outcomes among AI women has been attributed to their underutilization of the Pap test.^{4,11,12}

Limited health literacy--“the degree to which individuals have the capacity to obtain, process and understand basic health information and services to make appropriate health decisions”¹³--is a strong predictor of the underutilization of preventive health services such as cancer screening and poor health outcomes.^{4,14,15} Research on Asian and Hispanic immigrants show that those with low English proficiency have significantly lower health literacy levels than non-Hispanic Whites, which may lead to misconceptions about Pap testing, as well as an underestimation of their susceptibility to cervical cancer.^{4,12,15-17} The interplay between low health literacy and misconceptions about cancer risk has been found to contribute to a significant number of Asian and Hispanic immigrant women not screening for cervical cancer.^{4,14,16,17} Despite significant cervical cancer disparities, research on the cancer screening behaviors of AI women has been scarce. Epidemiological studies show a clear trend that recent immigrants often

present with diseases that are common in their country of origin.¹⁸ With a high incidence of cervical cancer in sub-Saharan Africa, and an exponential increase in Africans migrating to the US,³ there is a public health need to understand how health literacy influences Pap testing among AI women to ultimately decrease the incidence of cervical cancer in this vulnerable population.

The pathways through which health literacy affects health behaviors are not completely understood. Some studies report psychosocial factors (cancer knowledge, self-efficacy, decisional balance) as predictors of cancer screening behavior.^{15,19} Sources (family/relatives, friends, ethnic church, TV/Radio, Internet, social media, physician) and types (verbal, written text, pictures) of health information exchange are also suggested as a possible mechanism through which health literacy is shaped and health behaviors are adopted.²⁰ For example, a significant number of adults with low health literacy (i.e., who are not equipped with the adequate skills needed to evaluate health information), often seek health information and advice from their friends/family.^{21,22} Within the African cultural context, female friends/family serve as a central portal for the dissemination of women's health information,^{7,23–29} and hence, may play a crucial role in shaping health literacy and the adoption of health behavior such as cancer screening.^{30,31} Since health literacy can be modified through culturally appropriate interventions,¹⁹ it is imperative that we examine and understand how health literacy is shaped among AI women and how, in turn, health literacy influences their Pap testing behaviors.

Purpose and Specific Aims

The purpose of this explanatory mixed methods study is to understand how sources and types of health information exchange impacts health literacy and ultimately, Pap testing behaviors among AI women living in the US. The following specific aims are proposed:

Quantitative Aims:

Aim1: Examine the relationships of the number of sources (family/relatives, friends, ethnic church, TV/Radio, Internet, social media, physician) and types of health information (verbal, written text, pictures) with the level of health literacy among AI women.

Hypothesis 1: AI women who use multiple sources and types of health information will have higher health literacy levels than AI women who use a single source and type of health information.

Aim2: Examine the association among health literacy, psychosocial (cancer knowledge, self-efficacy, decisional balance, cultural beliefs/attitudes) correlates and Pap testing among AI women.

Hypothesis 2: Higher health literacy, higher cancer knowledge, higher self-efficacy, higher decisional balance, and negative cultural beliefs/attitudes will be associated with Pap testing after controlling for individual and screening related characteristics, sources and types of health information.

Qualitative Aim:

Aim3: Explore how sources and types of health information influence information sharing AI women Pap testing behaviors and how they seek health information using open-ended interviews.

Mixed Methods Aim:

Aim4: Describe how sources/types of health information impact health literacy and information sharing.

Research Question: How do sources and types of health information vary by levels of health literacy?

Conceptual Framework

An adapted Health Literacy Skills (HLS) conceptual framework guided the selection of study variables (see Figure 1).³² The original premise of the HLS framework is to address the multidimensionality of health literacy and illustrate “the full continuum of relations among predictors, mediators and outcomes of health literacy.”³² In African communities, female friends/family also serve as portals for the dissemination of women’s health information,^{7,23,29,33} and they play a crucial role in African women’s adaptation of health behaviors such as cancer screening.¹¹ Based on these findings, we adapted the HLS framework to include antecedents of health literacy (i.e., sources and types of health information), health literacy, and mediators (i.e. self-efficacy, decisional balance, cultural beliefs/attitudes and cancer knowledge) of the relationship between health literacy and health behavior.³²

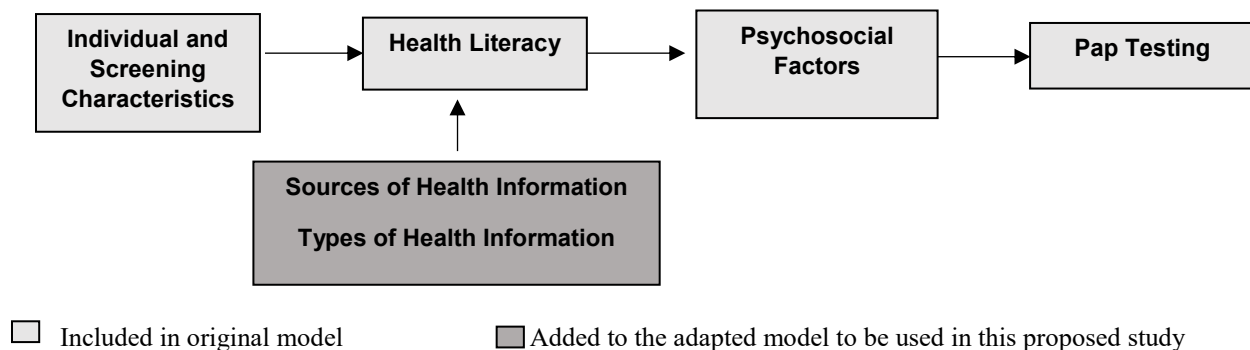


Figure 1. Adapted Health Literacy Skills Framework

Main constructs

Antecedents of health literacy

Sources of health information is defined as the interpersonal relationships made through social ties or with healthcare providers that influence health behaviors and health beliefs,^{34,35} and

included family/relatives, friends, ethnic church, TV/Radio, Internet, social media and physician/healthcare provider. *Types of health information* is defined as the communication strategies for disseminating health information with the aim of influencing health beliefs and behaviors,³⁴ and included verbal, written text and pictures.

Health literacy:

Health literacy is conceptualized as a multi-dimensional concept to include individuals' "ability to use medical terminology (familiarity) and apply relevant medical terms throughout the cancer screening trajectory (navigation)." ^{4,36}

Psychosocial factors

Cancer knowledge, conceptually defined as what a person knows about cervical cancer;³⁷ self-efficacy, defined as how confident a person is in carrying out tasks such as receiving a Pap test;³⁸ Decisional balance, conceptually defined as the perceived pros and cons of a health behavior,¹⁹ and Cultural beliefs/attitudes, defined as the principles, values and customs that inform a person's health behavior such as receiving a Pap test.³⁹

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CHAPTER 2

Empirically tested health literacy frameworks- A systematic review

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ABSTRACT

Background: Health literacy (HL) is a significant determinant of health behaviors. Yet, the pathways through which HL influences health behaviors are not completely clear, nor consistent. The purpose of this systematic review is to critically appraise studies that have empirically tested the potential pathways linking HL to health behavior.

Methods: We performed electronic database searches of PubMed, EMBASE and CINAHL to identify studies that proposed a conceptual framework and empirically tested the proposed mechanism through which HL influences certain health behaviors. Twenty eligible studies were included for analysis.

Results: The twenty studies addressed various health behaviors: chronic disease self-management (n=8), medication adherence (n=2), overall health status (n=4), oral care (n=1), cancer screening (n=1), shared decision making (n=1), health information sharing (n=1), physical activity and eating behaviors (n=1), and emergency room visits (n=1). Most studies were conducted in the US (n=13) and used a cross-sectional design (n=15). The S-TOHFLA was commonly used to assess HL levels. Variables selection and operationalization were informed by a theoretical model in twelve studies. Age, gender, race, and insurance status were reported antecedents to HL. The most commonly tested mediators were self-efficacy (n=8) and disease knowledge (n=4). Fit indices reported in the studies ranged from acceptable to excellent fit.

Discussion: Current evidence supports self-efficacy as a mediator between HL and health behavior. Further research is needed to identify how HL interplays with known psychosocial factors to inform individuals' utilization of preventive care services. Future studies should include more disadvantaged populations such as immigrants with high disease burden, and low HL. Theory based, empirically tested HL models can serve as the conceptual basis for developing effective health interventions to improve health behaviors and ultimately decrease the burden of disease in such vulnerable populations.

Plain Language Summary: This review systemically compiles, and critically appraises 20 existing studies that test conceptual frameworks which propose potential pathways through which HL impacts health behaviors. The findings from this review can help inform the development of health-literacy focused interventions to improve the health behaviors of disease burdened populations.

INTRODUCTION

Health literacy (HL) is a multidimensional concept which addresses a range of skills individuals need to effectively and efficiently function in a healthcare environment [1]–[3]. Individuals of older age and those who belong to low income, low education, immigrant and ethnic/racial minority groups often have low HL levels and have been found to have poor health outcomes [4]–[6].

There is a proliferation of studies on the impact of HL on health behavior (e.g., self-care, chronic disease management) and overall health outcomes [2], [7], [8]. These studies discuss the direct relationship between HL and health behaviors or health outcomes at the bivariate level. Recently, a growing body of research has revealed comprehensive pathways related to HL and health behaviors or outcomes. For example, psychosocial factors such as disease knowledge, self-efficacy and decisional balance—known determinants of health behaviors—were impacted by HL levels, and some studies have identified these psychosocial factors as potential mediators to the relationship between HL and health behavior [7]–[12]. However, what remains unclear is how theory informs the development of HL conceptual frameworks, and the methods used to empirically assess the proposed pathways through which HL influences health behavior [7], [8], [13], [14].

It is important to gain a comprehensive understanding of the theories that guide the systematic application and evaluation of variables used in addressing HL and health behaviors [13]. The purpose of this systematic review is to critically appraise studies that tested a theory-based HL conceptual framework. In addition, we were interested in discussing mechanisms through which HL influences health behavior and/or health outcome to build on empirical evidence.

METHODS

Search Strategy

In October 2017, we performed electronic database searches on —PubMed, EMBASE and CINAHL to identify studies that identify and empirically test a HL conceptual framework. Searches were not limited to a specific time frame. With the assistance of a health science librarian, we identified and used the following keywords and Medical Subject Heading (MeSH) in searching the electronic databases for relevant studies: “health literacy,” “theoretical models,” “conceptual frameworks” (see Appendix 1 for search terms used). Search terms were also truncated, exploded and other relevant Boolean operators were used to make the search as sensitive as possible. Electronic searches were also supplemented by a search on Google Scholar, and the reference lists of relevant articles were examined for articles that were not indexed by the electronic databases. In March 2019, we performed an additional database search using the same strategies we used in the initial search.

Study Eligibility

All studies were analyzed for their relevance to the purpose of our review. Studies that addressed the impact of HL on a health behavior or health outcome, described and empirically tested a conceptual framework, and were written in English were included in this review. Studies were excluded if they addressed HL as a study concept but did not empirically test a conceptual framework, did not address the impact of HL on health behavior, and were not published in English. Case studies, qualitative studies, conference abstracts, and study protocols and non-peer reviewed editorial works were also excluded. For the purposes of this paper, we define conceptual framework as a product that “graphically or narratively explains study variables and the presumed relationships among them” [15].

Study Selection and Data Extraction

Covidence©, an electronic systematic review tool was used in the study selection and data extraction process. Our initial database search yielded a total of 900 studies of which 169 duplicates were removed. To enhance the rigor of the systematic review process, two authors independently screened all abstracts and titles for relevance to empirical testing of HL models and frameworks. All conflicts and discrepancies were discussed and resolved through face to face group discussions. A total of 676 articles were excluded for non-relevance to our study's purpose. The full texts of 55 relevant abstracts were then reviewed independently by two authors, using the study's inclusion and exclusion criteria. We excluded 39 studies for the following reasons: (a) Studies did not include or propose a HL framework (n=27); (b) no empirical data presented (n=6); (c) studies do not address the impact of HL on health behavior (n=3); (d) studies do not include HL as a study variable (n=1), (e) no full text available (n=1); and (f) podium presentation (n=1). Using the same search terms (Appendix 1), an additional database search was conducted in March 2019 for studies published since November 2018. After removing duplicates, 90 titles with abstracts were reviewed for relevance. Two authors independently reviewed 17 full texts using the study's inclusion and exclusion criteria. A total of 13 articles were excluded for the following reasons: (a) Studies did not propose a HL framework (n=9); (b); studies do not address the impact of HL on health behavior (n=2); (c) studies were not written in English (n=1); and (d) no empirical data presented (n=1). See Figure 1 for detailed description of the selection process. Two authors extracted data from a total of 20 studies for this systematic review. To enhance interrater reliability and the accuracy of information presented, the authors compared key findings and other relevant data, and discrepancies were resolved.

Quality Assessment

The Joanna Briggs Checklist was the appraisal tool used in the quality assessment of all studies included in this review [16]. The checklist is a series of questions that authors of observational studies are expected to answer to enhance the studies' methodological rigor. Specifically, each study's quality was assessed using seven items addressing selection bias, measurement bias, confounding variables and appropriate usage of statistical analyses [16]. Studies were assigned a score of 1 for items that were adequately described, and a score of 0 for items which were not addressed by the authors. Total scores for each study ranged from 0-7, with a higher total score attributed to higher quality rating. Studies with a total score less than 3 received low quality rating, medium quality was assigned to studies with total scores ranging from 3-4 and studies with total scores ≥ 5 were rated high quality. Findings from the quality assessments were used to critique the overall methodological strengths and weaknesses of the studies.

Results of the quality assessment process are shown in Table 1. All the studies adequately described inclusion criteria and the characteristics of study participants. There was adequate discussion of items addressing selection bias in most studies included in the review: Description of inclusion criteria (n=19), description of study characteristics (n=15). Most studies included in the review inadequately addressed measurement bias: Identification of confounders (n=8); use of valid and reliable measurement of outcome (n=6); and strategy addressing confounders (n=8). The measurement of outcomes in more than 75% (n=15) of studies was based on self-reports. Overall, most studies had high (n=10) to medium (n=6) quality ratings. Only four studies received a low-quality rating.

RESULTS

Overview of studies included

The characteristics of all 20 of studies included in this review are detailed in Table 2. Most of the studies were published in the U.S (n=13) [6], [17], [26]–[28], [18]–[25], with the remaining published in China (n=2) [29], [30], Taiwan (n=2) [31], [32], Thailand (n=2) [33], [34], and South Korea (n=1) [35]. Study designs included cross-sectional (n=19) [6], [17], [26]–[32], [34], [35], [18]–[25] and mixed methods (n=1) [33]. Sample sizes ranged from 62 to 2,594, with only seven studies calculating sample sizes a priori [18], [27], [31]–[35].

Study participants in all the US-based studies were predominately female, urban dwelling, adults (age range: 18-75 years) with less than a high school education. In addition, the samples in US-based studies were >50% ethnic/racial minority groups (African Americans, Hispanics, American Indians/Alaska Natives) except three studies which included >60% Whites [18], [20], [24]. One US-based study, [6] however, did not report the race or ethnicity of study participants. All studies in this systematic review included adult participants (>18 years) except one study in Thailand which used national data from school-aged children between ages 9-14 years [33].

All studies measured one or more subdimensions of HL. Eight studies measured print literacy [17]–[19], [22], [24], [27]–[29], four studies measured numeracy [6], [17], [26], [27], and four studies measured functional literacy [23], [25], [32], [34]. Three studies addressed disease-specific HL: Diabetes [22], [24] and heart failure [30]. All studies used an existing and well validated HL measure except one study in Thailand which developed and validated the Health Literacy Scale for Thai overweight children (Cronbach's alpha: 0.70) [33]. The most common HL measures were the REALM [22], [24], S-TOFHLA [19], [26], [27] and TOFHLA (Osborn, Paasche-Orlow, et al., 2011; Schillinger et al., 2006). Additional measures included:

Health Literacy Scale (HLS), Brief Health Literacy Tool, the Mandarin version of the European Health Literacy Survey Questionnaire, and the Chinese Version of Health Literacy Scale for patients with Chronic Disease [30], [31], [35] which were mostly used in international studies (Taiwan, South Korea, Thailand and China) to assess functional HL in the context of breast cancer, chronic kidney disease, diabetes and heart failure management. Similarly, two studies conducted in the U.S. across ethnically diverse samples (predominately African American, non-Hispanic middle-aged women), assessed functional literacy using Chew's 3-item scale[20], [21].

Antecedents and outcomes of HL

Table 3 details the antecedents, mediators, moderators and outcomes of HL as outlined in the studies. All but four studies identified demographics and psychosocial factors as the most common antecedent to HL [21], [22], [30], [34]. The authors reported the following sociodemographic and medical characteristics: Age, education, income, health insurance status, race/ethnicity [17]–[20], [23], [25], [27], [32]; general literacy and language (English proficiency) [25], marital status [27], [31], Internet use [6], [28], disease duration [31] and cognition [26]. Older age [23], [32] low education [23], and African American race [23], [24] were linked to low HL whereas increased years of education [25], [29] and internet use [6], [28] were linked to high HL. A study conducted in China with a sample of low income, older adults (N=295, mean age=58 years) reported no association between age and HL, however [31]. Psychosocial antecedents included perceived health knowledge and perceived knowledge [6], [29], [31]. A statistically significant association was reported among perceived empowerment, prior knowledge and HL [29], [31]. One study among a sample of predominately middle aged (mean age: 38 years), females (69%) reported a non-statistically significant association between

perceived heart health knowledge and HL[6].The lack of association can be attributed to potential selection bias..

Studies addressed the following health behaviors and health outcomes: chronic disease self- management (n=9) [17], [18], [21]–[23], [25], [30], [31], [34], colorectal cancer screening (n=1) [28], medication adherence (n=2) [24], [26], overall health status (n=4) [27], [29], [32], [35], oral care (n=1) [20], health information sharing (n=1) [6], physical activity and eating behaviors (n=1) [33], shared decision making in relation to breast cancer care (n=1) [32] and emergency room visits (n=1) [19]. These studies reported that HL leads to better self-care and medication adherence, improved health status, improved self-reported oral health, less frequent emergency room visits, shorter hospitalizations, physical activity and healthy eating behaviors [17], [19], [20], [26], [29], [30], [32], [33]. However, HL did not impact information sharing behaviors [6], patients’ participation in shared decision making [32] and colorectal cancer screening [28]. Five studies did not find a significant association between HL and reported health behaviors (physical activity, medication adherence, glycemic control) or health outcomes (diabetic and chronic heart failure patients’ self-rated health) [22]–[25], [27], [31].

Pathways linking HL and health behaviors/outcomes

All but four studies assessed a number of variables as possible mediators between HL and health behaviors/outcomes [25], [32], [33]. Eight studies examined the mediating effect of self-efficacy on the relationship between HL and diabetes management, heart failure management and general self-care [18], [22], [26], [30], [31], [35]. Out of five studies which measured disease specific (diabetes, heart failure, chronic kidney disease) self-efficacy [22], [30], [31], [34], [35], four studies found self-efficacy as a statistically significant mediator [22],

[30], [31], [35]. However, only two studies [31], [35] controlled for possible demographic confounders (age, gender, education, marital status).

Four studies which examined how HL is related to health behavior through disease knowledge found the following: Only one study found a statistically significant mediating effect of knowledge in the context of diabetes management [17]; three studies found a direct association between HL and knowledge [18], [19], [23]. All four studies which examined the mediating effect of disease knowledge did not describe how knowledge instruments were scored, however. In addition, all four studies included a large proportion (65%-70%) of study participants with a high school level of education or less [18], [19], [23], [30].

Out of eight studies which examined self-care activities (medication adherence, physical activity, self-monitoring of blood glucose, foot care, healthy diet) as factors linking the pathway between HL and health outcomes (glycemic control, ER visits, blood pressure control, physical and mental health status) [17], [19], [21], [23], [27], [29], [31], [35], two reported a significant, mediating effect [17], [35]. Both studies controlled for known demographic covariates such as age, gender, education, marital status, treatment regimen (insulin or oral hypoglycemic use), hemoglobin A1C level, and duration of disease in the mediation analysis [17], [35].

Other proposed mediators included patient-provider interaction [20], [21], decisional balance [27], medication compliance [19], [26], preventive care use [19], [20], information overload [27] and attitude and beliefs towards information [6]. Only one study across a sample of predominately White (66%), urban dwelling adults (mean age=53 years) found that patient-dentist communication and the frequent use of dental care services mediates the relationship between HL (navigation) and self-rated oral health ($p=0.01$) [20]. The remaining studies found no statistically significant mediation pathways linking HL to health behaviors and outcomes [6],

[19], [21], [26]. Only 3 out of the 20 studies included in this review assessed the interaction of HL and study outcomes (glycemic control, medication adherence), but the authors did not describe this relationship as moderation [24]–[26].

Validation of theory-based conceptual frameworks

Fourteen studies reported good to excellent goodness of fit (GOF) where all indices were statistically significant; two studies did not report fit indices [27], [28]. Out of 20 studies included in this review, all but one hypothesized the relationships among proposed study variables [35]. Twelve studies used theory to inform the selection and operationalization of study variables [6], [18], [33], [34], [21], [23], [27]–[32]. Three studies validated the Paasche-Orlow and Wolf theory across a sample of low income, middle-aged (>50 years) adults with chronic disease [23], [27], [31]. Of the 3 studies, one study [31] which used participants' self-reports of glycemic control showed an acceptable framework fit, and an excellent framework fit was reported for the study [23] which used patients medical records. One study validated the Nutbeam health literacy model in the context of obesity prevention using a national sample of school aged children (N=2,000, age range=9-14 years); fit indices indicated a good fit [33]. One study conducted in China with a sample of city-dwelling adults (N=3,222) validated an adapted framework of various health literacy theoretical models (Baker, Paasche-Orlow and Wolf von Wagner and McCormack models) and reported a good fit of the proposed framework [29]. The authors of the study did not clearly describe how study variables were operationalized, however [29]. Two studies conducted in the U.S. [27], [28] also adapted multiple theoretical models (i.e. Paasche-Orlow and Wolf model, Bandura's Self-efficacy theory, Health Literacy Skills Framework and Cognitive Mediation Model) but failed to report fit indices. Additionally, five studies which reported good to excellent fit indices were informed by theories that do not specifically address

HL, but are commonly used in nursing and public health research to study health behaviors and overall health outcomes: Orem's Theory of Self-care and Bandura's Social Cognitive Theory, Theory of diffusion of innovations, Model of client health behavior (IMCHB), Individual and Family Self-Management Theory (IFSMT) and Capability opportunity motivation and behavior model (COM-B) [6], [18], [21], [30], [34].

DISCUSSION

To our knowledge, this is the first systematic review to critically appraise studies that have empirically tested the potential pathways linking HL to health behaviors and health outcomes. We found evidence to support that theoretically selected mediators (i.e., self-efficacy, disease knowledge, self-care activities, and patient-provider communication) interplay the identified relationship between HL and chronic disease management, with self-efficacy as the commonly tested mediator [31], [35]. Our findings show that unless people possess adequate HL, they may perceive low confidence in their abilities to manage their chronic diseases. In addition, improving people's HL is an essential first step to increasing their knowledge about their disease, improving their ability to adequately perform self-care activities, and effectively communicate and collaborate with healthcare providers in their chronic disease management [36], [37]. We also found evidence to support that intervention outcomes (glycemic control, medication adherence) differ by the health literacy levels of study participants, suggesting health literacy as a moderator [25], [26]. This finding highlights an important implication for future research, particularly in relation to intervention research as it relates to the role of health literacy beyond mediation.

We identified several factors which may have contributed to the mixed findings we reported: study design, selection bias, small sample sizes, measurement errors and non-theory

guided operationalization of study variables. Although all studies in this review aimed to examine the pathways linking HL to health behaviors and outcomes, these studies exclusively used a cross-sectional design which precludes causality and temporality. Secondly, only 7 out of 20 studies conducted sample size calculations and power analyses a priori [18], [27], [31]–[35]. The lack of statistical power in most of the studies could account for the mixed findings reported. Thirdly, although all US-based studies used well-validated HL measures, the remaining studies either lacked psychometric testing results or had only been tested in a single population therefore the validity and reliability of those measures could not be established [29]–[31], [33], [35]. Also important, studies were predominantly across a convenience sample of female, urban dwelling, adults with less than a high school education who were recruited from healthcare facilities. Therefore, findings cannot be generalized to other populations that do not utilize the healthcare system due to language barriers or a lack of health insurance. Finally, theory provides a systematic foundation and a logical pathway for illustrating the relationship among various study concepts and variables. However, only a limited number of studies (n=12) included in the review explained how theory informed the selection and operationalization of study variables-delimiting the generalizability of findings.

Findings from this review calls for the need to use theoretically grounded, methodologically rigorous research with statistically powered sample sizes to adequately examine the interplay between HL and health behaviors or outcomes in diverse study populations. For example, the studies included in this review exclusively used a cross-sectional design to test the indirect pathways linking HL to health behaviors. Hence, there is still a need for establishing temporality and causality using more rigorous study designs such as longitudinal cohort design. Several studies have used longitudinal data to examine the role of HL on health

behaviors and outcomes. However, they did not meet the inclusion criteria for this review because the authors' did not specify a HL conceptual framework to be tested [38], [39]. In addition, although a recent systematic review showed that HL has gained importance on the European health agenda, none of the studies identified from our extensive search of various database were conducted in Europe [40]. Further, among US-based studies, all the studies were conducted on female, English speaking adults [6], [17], [26]–[28], [18]–[25]. Although individuals who belong to ethnic/racial minority groups, and those with low English proficiency, particularly immigrants, are known to be disproportionately burdened by low HL, they were excluded from the US-based studies [13], [41]. In particular, African immigrants, an exponentially increasing immigrant group in the U.S. with worse health outcomes in comparison to other immigrant groups, were excluded in all the US-based studies [42]. While there is a possibility that African immigrants were categorized as African Americans in some of these studies, it has been established that individuals of African descent (African Americans, African immigrants and Afro-Caribbean) in the US have different cultural and linguistic characteristics which impacts their health outcomes differently. Therefore, there is a need to disaggregate these subgroups in health research [43], [44].

STRENGTHS

The Cochrane Collaboration and the US Institute of Medicine have endorsed that review teams must have content and methodological expertise [45]–[47]. A major strength of our study is the fact that our contributors have undergone training in systematic review methodology and have published prior review works. Additionally, most of the authors are clinicians with expertise in health promotion among populations with poor literacy. These skillsets helped us capture a heterogeneity of opinions and allowed for high interrater reliability when reviewing

articles for inclusion in the review. These strengths add to the degree of confidence when reporting our study findings, which also speaks to the thoroughness of this systematic review.

LIMITATIONS

This systematic review is limited in that despite our extensive database searches, there may be other relevant and unpublished studies that may not have been identified. Therefore, the theories we identified as guiding the development of HL conceptual frameworks may not be exhaustive. The majority of studies included in this review assessed HL using the REALM and TOFHLA which assess reading ability and comprehension respectively, but do not comprehensively address the multidimensionality of HL (i.e. ability to understand written text, speak and listening effectively and use quantitative data to make appropriate health decisions) [14]. Most studies used a cross-sectional design which precludes causality and temporality. In addition, we only included studies published in English. This may have also resulted in the small number of studies included in this review as well as the number of studies which included non-English speaking populations.

CONCLUSION

Our review adds to existing body of knowledge on the impact of HL on health behavior by providing a comprehensive understanding of how theory informs the development of HL conceptual frameworks, and the systematic selection and evaluation of variables which inform HL focused studies. We found evidence to support that HL is related to health behaviors, particularly chronic disease management through mediators such as self-efficacy and disease knowledge.

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Figure 1: Study selection process

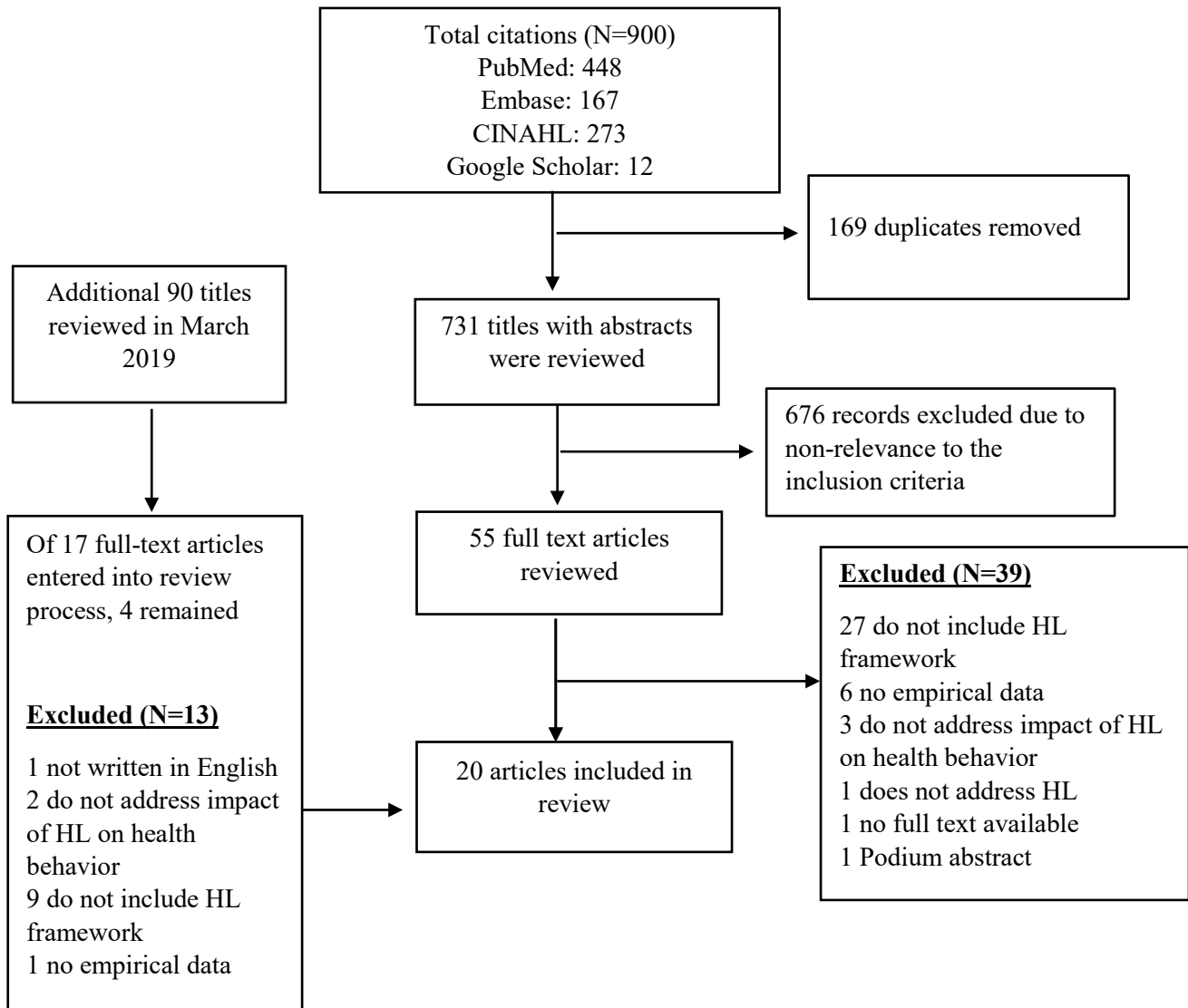


Table 1: Quality assessments of studies (N=20)

1 st author (Year)	Description of inclusion criteria	Description of study characteristics	Standard criteria used for measurement of the condition	Identification of confounders	Strategy for addressing confounding	Valid and reliable measurement of outcome	Statistical analyses	Overall quality
Brega (2012)	1	1	1	1	1	1	1	High
Chen (2014)	1	1	1	0	0	0	1	Medium
Cho (2008)	1	1	0	0	0	0	1	Medium
Como (2018)	1	1	1	1	1	1	0	High
Crook (2016)	1	0	0	0	0	0	1	Low
Guo (2014)	1	0	0	1	1	0	1	Medium
Hickman (2016)	1	1	1	0	0	0	0	Medium
Huo (2018)	1	1	1	0	0	1	1	High
Intarakamhang (2017)	1	0	0	0	0	0	1	Low
Jin (2018)	1	1	0	1	1	0	1	High
Lee, EH (2016)	1	1	0	0	0	0	1	Medium
Lee, YJ (2016)	1	1	1	0	0	1	1	High
Osborn (2011a)	0	0	0	0	0	0	1	Low
Osborn (2010)	1	1	1	0	0	1	1	High
Osborn (2011b)	1	1	0	0	0	0	1	Medium
Photharos (2018)	1	0	1	0	0	0	0	Low
Schillinger (2006)	1	1	1	1	1	1	1	High
Soones (2017)	1	1	1	1	1	0	0	High
Sun (2013)	1	1	0	1	1	0	1	High
Zou (2017)	1	1	0	1	1	0	1	High

1: Clearly discussed; 0: Not discussed

Table 2: Study characteristics and main findings

1 st author (Year)	Study purpose	Design	Setting/Sample	HL domains [HL Measure]	Main results
Brega (2012)	To develop a theoretical framework and test the mechanisms through which HL is associated with outcomes, focusing on the relationship between HL and glycemic control among American Indians and Alaska Natives with diabetes	Cross-sectional	2,594 rural dwelling adults with diabetes Country: USA Age range: 18-65y; income: <\$10,000; 93% less than college graduates; Ethnicity: 100% American Indian and Alaska native HL levels: not stated	Print literacy [TOHFLA] Numeracy [Not stated]	High HL associated with decreased A1C levels (B= -0.070, p<0.05). Significant association between high HL and healthy behaviors (frequent healthy diet, monitor blood sugar). Self-monitoring of blood sugar mediates HL and glycemic control (B= -0.028, p<0.05). Diabetes knowledge is a significant mediator between HL and glycemic control (B=-0.134, p<0.05).
Chen (2014)	Test a model to explain the relationships between HL, heart failure knowledge, self-efficacy and self-care	Cross-sectional	63 urban dwelling adults with heart failure Country: USA Mean age: 62.1y; Mean years of education: 13.7y; Female: 47.6%; Ethnicity: 86% White; 11% African American; 2% Hispanic/Latino, 2% American Indian/Alaskan Native HL levels: inadequate: 16%; marginal: 16%; Adequate: 68%	Print literacy [S-TOHFLA]	Direct relationship between HL and heart failure knowledge (B=0.46, p <0.05). Heart failure knowledge and self-efficacy do not mediate the relationship between HL and heart failure self-care.
Cho (2008)	Explore intermediate factors that link HL to health status and utilization of health services (ER visit, hospitalization)	Cross-sectional	489 urban dwelling, Medicare recipient adults Country: USA Age: ≥65 years Avg education level: HS graduate Female: 78.7% Ethnicity: 59.1% African American HL levels: inadequate: 51%	Print literacy/comprehension [S-TOFHFLA]	Positive, direct relationships between HL, health status (B=0.48, p<0.05); direct negative relationship between HL and hospitalization and ER visits respectively (B=-0.24 and B=-0.35). Compliance and disease knowledge are not significant mediators between HL and outcomes (health status, hospitalizations, ER visit). HL mediates educational attainment and outcomes (health status, hospitalization and ER visits)

Como (2018)	Investigate whether HL, self-efficacy and medication adherence can explain or predict the variance in health outcomes (perceived physical or mental health status) in persons with chronic heart failure	Cross-sectional	175 urban dwelling adults diagnosed with heart failure and attending cardiology health centers in New York Country: USA Mean age: 73y; Male: 66.9%; Ethnicity: 11.4% African American, 83.4% White; 4% Hispanic, 0.6% Asian, 0.6% Native American <HS Education: 57% English as second language: 19.4% HL levels: inadequate: 38.3%; adequate: 45.7%	Print literacy/comprehension Numeracy [S-TOFHLA]	Self-efficacy is associated with physical health status ($p=0.002$). Education, income, marital status (widow), illness severity indicators [number of medication/days, frequency/day] are significant predictors of physical health status ($p<0.001$). No associations between HL, medication adherence and physical health status. Medication adherence does not mediate the relationship between HL and physical health status. Medication adherence ($p<0.001$), numeracy ($p=0.029$) and reading comprehension ($p=0.049$) are associated with mental health status. Medication adherence does not mediate the relationship between HL and mental health status
Crook (2016)	Explain the associations among perceived health knowledge, information sharing, attitudes, behaviors and HL	Cross-sectional	180 English speaking adults recruited from a central Texas acute and preventive care center Country: USA Age range: 18-75y; Mean age: 38.7y ± 13.2 ; Female: 69%; Education: not reported Ethnicity: not reported HL levels: not stated	Numeracy [Newest Vital Sign]	Internet use positively associated with HL level ($B=0.55$, $p<0.001$). Attitude toward information mediates relationship between HL and behavioral intention ($p<0.001$) as well as the relationship between HL and information sharing ($p<0.001$). No significant association between perceived healthy heart knowledge and HL ($B=0.14$, $p=0.14$). High perceived healthy heart knowledge associated with positive attitudes towards health information ($B=0.13$, $p=0.03$) and lower perception of information overload ($B=-0.14$, $p=0.01$)
Guo (2014)	Examine effects of HL, patient-dentist communication, dental care patterns on self-rated oral health status	Cross-sectional	1799 rural dwelling adults in Florida Country: USA Mean age: 52.9y; HS graduate or lower: 53% Female: 53%; Ethnicity: 34% African American; 66% White HL levels: low: 31%; 23%; high: 69%	Navigation [Chew's 3-item HL scale]	Significant direct association between HL and self-rated oral health ($B=0.091$, $p<0.001$). Patient-dentist communication and dental care patterns mediate the relationship between HL and self-rated oral health ($B=0.003$, $p=0.01$)
Hickman (2016)	Examine predictive associations among HL, quality of the provider interaction, perceived communication skills and behavioral activation on blood pressure control	Cross-sectional	109 English speaking, urban community-dwelling adults with hypertension in Northeast Ohio. Country: USA Mean age: 52y (± 11); Education: not reported; Female: 59%; Income: not reported; Ethnicity: 68% African American, 24% Caucasian, 5% Hispanic, 3% Multi-racial HL levels: not stated	Navigation [Chew's one-item HL scale]	HL ($B=0.15$, $p<0.10$), quality of provider interaction ($B=0.38$, $p<0.01$), perceived communication skills ($B=0.22$, $p<0.05$) directly associated with behavioral activation. Provider interaction ($B=0.27$, $p<0.001$) and behavioral activation ($B=-0.29$, $p<0.001$) are directly associated with blood pressure control

Hou (2018)	To examine the mechanisms and completeness of the Integrated Model of HL	Cross-sectional	<p>511 adults diagnosed with breast cancer and attending breast surgery clinics and teaching hospitals</p> <p>Country: Taiwan</p> <p>Mean age: 57.9y; <HS graduate: 31.7%; Married: 71.6%; Residence: 75% urban dwellers; Employment: 44% unemployed; Average duration of cancer diagnosis: 43months; HL levels: inadequate: 37.5%;</p>	<p>Functional, comprehension,</p> <p>[Mandarin version of HLS-EU-Q]</p>	<p>Age and cancer stage are inversely related to HL ($p<0.05$). Education ($B=0.41$, $p<0.05$), cancer duration ($B=0.27$, $p<0.05$) significantly associated with HL. Significant associations among patients' participation in shared decision making ($B=0.46$, $p<0.05$), self-rated health status ($B=0.27$, $p<0.05$) and HL. No associations among marital status, place of residence, occupation and HL</p>
Intarakamhang (2017)	Develop a scale for evaluating HL level of Thai childhood overweightness and develop a model of health behavior to prevent obesity	Mixed methods	<p>2000 population-based sample of urban and provincial dwelling Thai students</p> <p>Country: Thailand</p> <p>Age range: 9-14y; Education: not reported; Sex: not reported; Income: not reported; Ethnicity: 100% Asian</p> <p>HL levels: not stated</p>	<p>Media, Functional, Navigation</p> <p>[HL scale for overweight Thai children^a]</p>	<p>Direct effect of critical skills (media literacy and making appropriate health-related decision) on obesity preventive behaviors (eating, exercise and emotional behaviors) [$B=0.55$, $p<0.05$]. Basic intelligence skills (health knowledge, accessing information and services) directly related to interactive skills (communication and managing health conditions) [$B=0.76$, $p<0.05$]</p> <p>Direct relationship between interactive skills and critical skills ($B=0.97$, $p<0.05$).</p>
Jin (2018)	Examine hypothetical pathways through which online health information seeking behaviors [using emails to communicate with providers; visit social networking site to read and share medical topics] influence HL, which, in turn, leads to colorectal cancer screening among Korean Americans	Cross-sectional	<p>433 Korean American adults living in southeastern U.S</p> <p>Country: USA</p> <p>Mean age: 57.6y, Female: 60.8%; Family history of cancer: 54.6%; No personal history of cancer: 85.4%; Education: not reported; HL levels: not stated</p>	<p>Print literacy, comprehension</p> <p>[Brief HL Screening Tool]</p>	<p>Online health information seeking behaviors associated with HL ($B=0.146$, $p<0.001$) and information overload ($B=0.179$, $p<0.01$). Information overload inversely associated with HL ($B=-0.242$, $p<0.001$). Decisional balance associated with HL ($B=0.124$, $p<0.05$), fecal occult blood test ($B=0.161$, $p<0.05$) and sigmoidoscopy uptake ($B=0.169$, $p<0.01$)</p> <p>HL not significantly associated with fecal occult blood test (FOBT), sigmoidoscopy and colonoscopy uptake</p> <p>HL does not mediate the relationship between online information seeking and colorectal cancer screening</p>
Lee, EH (2016)	Explore the relationships among HL, self-efficacy, self-care activities and health-related quality of life (HRQOL)	Cross-sectional	<p>459 Korean speaking adults diagnosed with type 2 diabetes, recruited from university hospitals in South Korea between 2014-2015</p> <p>Country: South Korea</p> <p>Age range: 20-70y; Mean age 59.60y (± 10.57); Female: 60%; < HS graduate: 32%; Income: not reported</p> <p>HL levels: not stated</p>	<p>Functional(communication)</p> <p>[Health Literacy Scale]</p>	<p>Direct effect of HL on self-efficacy ($B=0.45$, $p<0.001$) and self-care activities ($B=0.209$, $p<0.001$). Self-efficacy mediates relationship between HL and self-care activities ($B=0.299$, $p=0.005$). Self-care activities is directly related to HRQOL ($B=0.399$, $p<0.001$). No direct effect of HL on HRQOL. Self-care activities mediates relationship between HL and HRQOL ($B=0.203$, $p=0.002$). Self-care activities mediates relationship between self-efficacy and HRQOL ($B=0.265$, $p=0.004$)</p>

Lee, YJ (2016)	Validate a hypothesized model exploring the influencing pathways of empowerment perceptions, HL, self-efficacy and self-care to HbA1C levels among type II diabetes patients	Cross-sectional	295 convenience sample of adult patients diagnosed with Type 2 diabetes > 6 months and attend endocrine outpatient clinics in Southern Taiwan Country: Taiwan Age range: 20-80y; Mean age: 58.2y; Female: 42%; <HS graduate: 37.3%; Income: 68% low SES HL levels: not stated	Functional (communication) [Health Literacy Scale]	Non-significant association between age and HL, HL and self-care behaviors, empowerment and self-efficacy, empowerment and self-care behaviors. HL mediates relationship between empowerment and self-efficacy (B=0.39, p<0.001). Self-efficacy and HL also mediate the relationship between self-care behaviors and empowerment (B=0.26, p<0.001). Self-efficacy is the mediator between HL and self-care behaviors (B=0.47, p<0.001). Self-care behaviors mediates self-efficacy and glycemic control (B=-.14; p<0.05)
Osborn (2011a)	Test whether HL and/or numeracy are related to diabetes medication adherence and whether either factor explained racial differences in adherence to diabetes medications.	Cross-sectional	383 English speaking, urban, rural and suburban dwelling adults living in North Carolina and Tennessee diagnosed with Types 1 and 2 diabetes Country: USA Age range: 18-85y; Mean age: 54y; Female: 50%; Ethnicity: 35% African American; <HS graduate: 44%; Income ≥ \$20,000: 56% HL levels: not stated	Diabetes related numeracy [Diabetes Numeracy Test] Print literacy [REALM]	HL does not mediate relationship between African American race and diabetes medication adherence. Direct negative association between AA race and HL (B=-0.28, p<0.001). Non-significant association between HL and medication adherence (p=0.06). Direct association between duration of diabetes and medication adherence (B=0.13, p<0.01)
Osborn (2010)	Examine the predicted pathway linking HL, numeracy and diabetes self-efficacy to glycemic control	Cross-sectional	383 English speaking, urban, rural and suburban dwelling adults living in North Carolina and Tennessee diagnosed with Types 1 and 2 diabetes Country, USA Age range: 18-85y; Mean age: 54y; Female: 50%; Ethnicity: 35% African American; >HS education: 56%; Income ≥ \$20,000: 56% HL levels: not stated	Diabetes related numeracy [Diabetes Numeracy Test] Print literacy [REALM]	Younger age (p<0.001), insulin use (p<0.001) increased duration of diabetes diagnosis (p<0.01), AA race(p<0.01) are directly associated with higher A1c levels. Greater self-efficacy associated with lower A1C levels (r=-0.25, p<0.001). Model accounted for 21% variability in A1C. No direct relationship between HL and glycemic control (A1c). Self-efficacy mediates relationship between general numeracy and glycemic control (p<0.05)
Osborn (2011b)	Validate the Paasche-Orlow and Wolf model examining mechanisms linking HL to physical activity and self-reported health status	Cross-sectional	330 English speaking adults with hypertension recruited from clinics across the US. Country: USA Mean age: 53.6y, Female: 68%; <HS education graduate: 70.7%; Ethnicity: 79% African American; Unemployed:	Functional literacy [S-TOFHLA]	Low education (B=0.56, p<0.001), African American race (B=0.51, p<0.001), older age (B=0.36, p<0.001) directly associated with low HL. High HL associated with high knowledge (B=0.22, p<0.001). Self-efficacy directly related with health status (B=0.17, p<0.01). No association between self-care behavior and health status. Non-significant relationship between race and self-efficacy (B=0.10). Knowledge mediates

			66%; Uninsured: 44% HL levels: not stated		relationship between HL and self-efficacy (B=0.045, p<0.001)
Photharos (2018)	Develop and test the causal relationships among family functioning, HL, chronic kidney disease self-efficacy, illness perceptions, social support and self-management behaviors among persons experiencing early stages of chronic kidney disease	Cross-sectional	275 adults experiencing early stage chronic kidney disease and receiving medical treatment Country: Thailand 60% male; <College educated: 68%; Family history of chronic kidney disease: 19%; History of hypertension: 36.7%; History of diabetes and hypertension: 29.5% HL levels: not stated	Functional, communication, critical literacy [Health Literacy Scale]	HL (B=0.31, p<0.0), family functioning (B=0.53, p<0.05) directly associated with chronic kidney disease (CKD) self-efficacy. HL (B=0.37, p<0.05), social support (B=0.24, p<0.05) directly associated with self-management behaviors. Family functioning is related to self-management behaviors through social support (B=0.15, p<0.05). CKD self-efficacy does not mediate the relationships among HL, family functioning and self-management behaviors
Schillinger (2006)	Explore the pathway linking HL, education and glycemic control	Cross-sectional	395 adults with diabetes recruited from primary care clinics between June & December 2000 in San Francisco Country: USA Mean age: 57.9y; Ethnicity: 18.5% Asian/Pacific Islander, 25.3% Black, 13.9% White, 42.3% Hispanic; Uninsured: 30.6%; Primary English speakers: 51.7%; <HS Graduate: 46.8%; <\$10,000 income: 68.8% HL levels: not stated	Functional Literacy[s-TOFHLA]	Direct relationship between educational attainment and HL: high school (B=0.24, p<0.05), some college (B=0.51, p<0.05); Direct association between educational attainment and glycemic control: high school (B= -0.11, p<0.05), some college (B= -0.06, p<0.05). HL mediates relationship between educational attainment [high school education (B= -0.04, p<0.05) and some college education (B= -0.08, p<0.05) and glycemic control.
Soones (2017)	Describe causal pathway linking HL to medication adherence	Cross-sectional	433 older adults with asthma recruited from hospital and community practices in NY and Chicago Country: USA Age range: 60-70y; Mean age: 67y, Female: 84%, <HS graduate: 32.6%; Less than \$1350/month: 54%; Ethnicity: 31% Blacks, 39% Hispanics HL levels: adequate: 64%; limited: 36%	Comprehension and numeracy [s-TOFHLA]	Concerns about medication associated with low HL (B= -0.154, p<0.001) and lower medication adherence (B= -0.2, p<0.004). Low HL associated with low medication adherence through medication concerns (B=0.033, p=0.002). Direct relationship between HL and medication adherence (B=0.123, p<0.001). Cognition directly associated with HL (B= -0.767, p<0.001). Non-significant relationships between HL and medication necessity and illness beliefs and medication adherence.
Sun (2013)	Develop and validate a HL model to explain the determinants of HL and the associations between HL and health behaviors	Cross-sectional	3222 city-dwelling Chinese adult residents Country: China	Print literacy, numeracy [Skill-based HL tool] ^a	Education has positive and direct effect on prior knowledge of infectious respiratory diseases (B= 0.324, p<0.01) and HL (B=0.346). HL directly related to health behavior (B=0.101). Age directly associated with health status (B=0.107)

			Age range: 16-81y, mean age: 33.8y; <HS graduate: 38.4%, Ethnicity: 100% Asian; Income < 3000 Yuan (~ \$438): 83.2% HL levels: not sated		
Zou (2017)	Explore factors associated with self-care behaviors and examine mediating role of self-care confidence	Cross-sectional	321 adult chronic heart failure patients recruited from cardiovascular units in Shandong, China Country: China Mean age: 64y, Female: 49%, < HS graduate: 65.1%; Unemployed: 59.2%; Income < 1000 Yuan (~ \$155): 27.4%; Ethnicity: 100% Asian HL levels: not stated	Functional Literacy [Chinese version of Health Literacy Scale for patients with Chronic Disease]	Functional capacity (B=0.155, p<0.01) and knowledge (B=0.321, p<0.01) directly associated with self-care management. HL (B=0.043, p<0.01) and social support (B=0.146, p<0.01) are directly associated with self-care maintenance. Self-care confidence is directly associated with both self-care maintenance (B=0.123, p<0.05) and management (B=0.309, p<0.01). Age (B=0.194, p<0.01) and health failure duration (B=0.105, p<0.05) are significantly associated with self-care maintenance. Self-care confidence mediates relationships between knowledge (B=0.0225, p<0.01), HL (B=0.162, p<0.01) social support (B=0.174, p<0.01) and self-care behaviors

REALM: ; TOFHLA: Test of Functional HL in Adults; s-TOFHLA: Short version of the Test of Functional HL in Adults; HLS-EU-Q: European HL Survey Questionnaire; SES: Socioeconomic status

*: HL instrument designed for purposes of study,

Table 3: Theoretical frameworks of HL

1 st author (Year)	How framework was informed	Proposed antecedents to HL	Proposed mediators and moderators	Hypothesis tested	Health behaviors/Outcomes	Fit indices for final models
Brega (2012)	<i>Not stated</i>	Age, gender, income, education	Mediators: Diabetes knowledge; Behavior (Healthy and unhealthy food consumption, physical activity, self-monitoring blood glucose) Moderators: <i>None</i>	Diabetes-related knowledge and behavior (healthy diet; physical activity; self-monitoring of blood sugar) mediate relationship between HL and glycemic control	Glycemic control	$X^2 = 976.78$, $df=255$ (p not reported) CFI: 0.85 RMSEA: 0.03 Acceptable fit
Chen (2014)	Orem's Theory of Self-Care; Bandura's Social Cognitive Theory	Years of formal education	Mediators: Knowledge; Self-efficacy Moderators: <i>None</i>	Formal education is associated with HL and has a direct effect on heart failure knowledge; Direct relationship between HL, health failure knowledge and self-efficacy; Heart failure knowledge mediates relationship between HL and self-efficacy; Heart failure knowledge and self-efficacy mediate the relationship between HL and self-care	Heart failure Self-care (maintenance and management)	$X^2=3.05$, $df=4$ ($p=0.55$) CFI: 1.00 RMSEA: 0.00 GFI: 0.98 NFI: 0.95 Good model fit
Cho (2008)	<i>Not stated</i>	Gender, race and education	Mediators: Disease knowledge; Health behavior; Preventive care; Medication Compliance Moderators: <i>None</i>	Mediating factors [disease knowledge, health behavior, preventive care and compliance with medication] link HL and outcomes [health status, healthcare, ER visit and hospitalization]	Health status, hospitalization, ER visit	$X^2 = 15.26$, $df=13$ ($p=0.29$) RMSEA: 0.00 AGFI: 0.91 NFI: 0.99 Adequate fit
Como (2018)	Paasche-Orlow and Wolf Bandura's self-efficacy theory	Patient demographics (age, education, ethnicity), Social factors (employment, income, language, social support, marital status), Illness Severity indicators (number of medications/days, frequency/day)	Mediators: Medication adherence; Self-efficacy Moderators: <i>None</i>	HL, medication adherence and self-efficacy are associated with physical health status; Medication adherence mediates the relationship between HL and physical health status; HL, self-efficacy, medication adherence are associated with mental health status; Medication adherence mediates the relationship between HL and mental health status	Health outcomes (physical health status, mental health status)	<i>Not reported</i>
Crook (2016)	Theory of diffusion of innovations	Perceived health knowledge. Internet use	Mediators: Information overload; Attitude toward information Moderators: <i>None</i>	Frequent internet use is directly related to high HL; Higher perceived health knowledge directly related to frequent internet use, high HL, positive attitude towards information and lower perception of information overload Higher HL associated with lower levels of information overload and positive attitudes towards information	Behavioral intention, information sharing	$X^2= 13.00$, $df=12$ ($p =0.37$) RMSEA: 0.02 CFI: 1.00 TLI: 0.99 SRMR: 0.06 Good model fit

				<p>Perceived level of information overload negatively predicts attitude toward information</p> <p>Intention to share information positively predicts behaviors intentions; attitude toward information positively predicts behaviors intentions and information-sharing intentions</p> <p>Attitude toward information mediates relationship between HL and behavioral intentions; and relationship between perceived overload and information-sharing intentions</p>		
Guo (2014)	<i>Not stated</i>	Age, gender, race, education, income, having a regular dentist	<p>Mediators: Patient-dentist communication Dental care patterns</p> <p>Moderators: <i>None</i></p>	Hypothesis: High HL associated with better patient-dentist communication and better communication is in turn associated with increased likelihood to seek regular dental care resulting in better self-rated oral health	Self-rated oral health	$X^2 = 0.43$, ($p=0.51$) RMSEA: 0.01 CFI: 0.99 Good model fit
Hickman (2016)	Model of Client Health Behavior (IMCHB)	None	<p>Mediators: Quality of provider interaction Perceived communication skills Behavior activation</p> <p>Moderators: <i>None</i></p>	The association between HL and blood pressure control is mediated by quality of provider interaction, perceived communication skills and behavioral activation	Blood pressure control	$X^2 = 1.1$, ($p = 0.76$) CFI: 1.0 RMSEA: 0.00 SRMR: 0.03 TLI: 1.1 Excellent fit
Hou (2018)	Integrated Model of HL (IMHL)	Age, education, cancer stage, time since diagnosis, marital status, residential area, occupation	<p>Mediators: <i>None</i></p> <p>Moderators: <i>None</i></p>	Intercorrelated determinants of HL (age, education, cancer stage, time since diagnosis, marital status, residential area, occupation) predict patients' HL and influence the consequences of HL (participation in decision making, self-rated health status). There is direct relationship between determinants and consequences of HL	Participation in shared decision making Self-rated health status	$X^2 = 55.12$, $df=32$ ($p = 0.007$) RMSEA: 0.04 CFI: 0.99 SRMR: 0.03 AIC: -8.88 Good model fit
Intarakamhang (2017)	Nutbeam model	Health knowledge	<p>Mediators: <i>None</i></p> <p>Moderators: <i>None</i></p>	Direct relationship between basic health skill [health knowledge and understanding] and eating behaviors; Association between basic health skill [health knowledge and eating behaviors] is mediated by interactive skills [communicating for added skills] and critical skills [making appropriate health-related decision]	Obesity preventive behaviors (eating behaviors, exercise behaviors and emotional coping)	$X^2 = 60.10$, $df=12$ ($p = 0.00$) RMSEA: 0.05 CFI: 0.99 AGFI: 0.99 PNFI: 0.72 Good model fit
Jin (2018)	HL Skills Framework, Cognitive Mediation Model	Online information seeking behaviors [using emails to communicate with providers; visit social networking site to read and share medical topics]	<p>Mediators: Decisional balance, Information overload</p> <p>Moderators: <i>None</i></p>	a. Online health information seeking behavior is positively associated with HL b. Online health information seeking behavior is associated with information overload c. Information overload is inversely associated with HL d. HL is positively associated with colorectal cancer screening e. HL is positively associated with decisional balance	Colorectal cancer screening	<i>Not reported</i>

				f. Decisional balance is positively associated with colorectal cancer screening		
Lee, EH (2016)	<i>Not stated</i>	Age, gender, education, marital status, treatment regimen (diet/exercise, insulin, oral hypoglycemic only, oral hypoglycemic & insulin), Hemoglobin A1C (HbA1c), Duration of disease	Mediators: Self-efficacy; Self-care activities Moderators: <i>None</i>	Study Aim: Test relationship among HL, self-efficacy, self-care activities and HRQOL	Health Related Quality of Life (Emotional suffering, social functioning, adherence to treatment, diabetes specific symptoms)	$X^2 = 265.79$, df=71 RMSEA: 0.07 CFI: 0.92 GFI: 0.92 SRMR: 0.07 NFI: 0.92 Good model fit
Lee, YJ (2016)	Paasche-Orlow and Wolf model	Education, age, empowerment perceptions	Mediators: Self-efficacy; Self-care behaviors (medication, exercise, diet, blood sugar monitoring, adversity prevention) Moderators: <i>None</i>	a. Self-care behaviors mediate relationship between HL and Glycemic control (HbA1c). b. Direct relationships: a. HL and self-efficacy; b. HL and glycemic control; c. Empowerment and HL, self-care behaviors, self-efficacy and glycemic control	Glycemic control (HbA1c)	$X^2/df = 1.79$ RMSEA: 0.052 CFI: 0.94 GFI: 0.95 AGFI: 0.96 AIC: 145.25 Acceptable model fit
Osborn (2011a)	<i>Not stated</i>	Race	Mediators: <i>None</i> Moderators: <i>None</i>	African American (AA) race associated with poor medication adherence; numeracy associated with medication adherence and explains association between race and adherence	Medication adherence	$X^2 = 0.08$, (p = 0.78) RMSEA: 0.00 CFI: 1.00 Excellent model fit
Osborn (2010)	<i>Not stated</i>	None	Mediators: Diabetes self-efficacy Moderators: <i>None</i>	a. HL is directly related to glycemic after controlling for demographics (age, gender, race, education, income, insulin use, diabetes type and years since diagnosis). b. Self-efficacy mediates HL and glycemic control	Glycemic control	$X^2 = 6.17$, (p=0.41) CFI: 1.00 RMSEA: 0.01 Excellent model fit
Osborn (2011b)	Paasche-Orlow and Wolf	Race, education, age	Mediators: Knowledge; Self-efficacy; Self-care Moderators: <i>None</i>	a. Patient demographics (race/ethnicity, education, age) predict HL b. HL predicts determinants of self-care at the patient level (knowledge and self-efficacy) c. Patient-level determinants of self-care predict self-care behavior (physical activity) d. Self-care behavior predicts health status (subjective health)	Health status (subjective health)	$X^2 = 6.75$, (p= 0.40) RMSEA: 0.01 CFI: 1.00 Excellent model fit
Photharos (2018)	Individual and family self-management theory (IFSMT)	None	Mediators: Chronic kidney disease self-efficacy Moderators: <i>None</i>	Family functioning, illness perception and HL directly affect self-management behaviors and indirectly affect self-management behaviors through chronic kidney disease self-efficacy	Self-management behaviors (adherence to chronic kidney disease recommendation, self-integration, problem	$X^2/df = 1.63$ RMSEA: 0.48 GFI: 0.93 AGFI: 0.90

				Family functioning influences self-management behaviors through social support	solving, seeking social support)	Acceptable model fit
Schillinger (2006)	<i>Not stated</i>	Educational level, age, primary language, health insurance status	Mediators: <i>None</i> Moderators: <i>None</i>	HL mediates the relationship between education level and glycemic control	Glycemic control	$X^2 = 12.22$, $df = 31$ ($p = 0.10$) RMSEA: < 0.0001 CFI: 1.00 AGFI: 0.99 Good model fit
Soones (2017)	<i>Not stated</i>	Cognition	Mediators: Illness beliefs; Medication concerns; Medication necessity Moderators: <i>None</i>	Asthma illness and medication beliefs mediate the relationship between HL and medication adherence	Medication adherence	RMSEA: 0.05 CFI: 0.93 Adequate fit
Sun (2013)	Baker, Paasche-Orlow von Wagner, and McCormack HL models	Age, education, income, Prior knowledge of infectious respiratory diseases	Mediator: Health behavior Moderator: <i>None</i>	a. Prior knowledge influences development of HL skills b. HL has direct effect on health behaviors c. HL mediates relationship between prior knowledge and health behavior d. Health behavior influences health status	Health status	X^2 : 10.22, $df=6$ ($p=0.1159$) RMSEA: 0.05 CFI: 0.10 AGFI: 0.10 Good model fit
Zou (2017)	Capability opportunity motivation and behavior model (COM-B)	None	Mediator: Self-care confidence Moderator: <i>None</i>	Capability [functional capacity, knowledge, HL] and Opportunity (social support, socioeconomic status) are associated with Behavior [self-care maintenance, self-care management] through motivation [self-care confidence]	Heart failure Self-care maintenance Heart failure Self-care management	$X^2 = 14.04$, $df=11$, ($p = 0.23$) RMSEA: 0.029 CFI: 0.99 Good model fit

X^2 : Chi Square, DF: Degrees of Freedom, CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation; GFI: Goodness of Fit index, NFI: Normed fit index, AGFI: Adjusted Goodness of Fit; AIC: Akaike Information Criterion;

Appendix 1: Database search strategy

Pubmed

((("HL"[Mesh] OR "HL")) AND ("Models, Theoretical"[Mesh] OR "conceptual framework" OR "conceptual frameworks" OR "conceptual model" OR "conceptual models"))

CINAHL

((MH "Conceptual Framework") OR ("conceptual framework") OR (conceptual N3 (framework* OR model*)) OR (MH "Models, Theoretical+") OR ("theoretical models") AND ((MH "HL") OR ("HL") OR (health N3 (literacy OR literate OR illiteracy OR illiterate))

Embase

'HL'/exp OR (health NEAR/3 (literacy OR literate OR illiterate OR illiteracy)):ab,ti AND 'conceptual framework'/exp OR (conceptual NEAR/3 (framework* OR model*)):ab,ti OR 'theoretical model'/exp

CHAPTER 3

Understanding the Pap testing behaviors of African immigrant women in developed countries: A systematic review

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ABSTRACT

Background: African immigrant (AI) women are burdened by cervical cancer, but the prevalence and correlates of Pap testing remains unclear in this population.

Objective: To review studies on the prevalence and determinants of Pap testing among AI women.

Methods: PubMed, CINAHL, Embase, and Scopus were searched for relevant articles. The Andersen Behavioral Model guided synthesis of the key findings.

Results: Sixteen studies met inclusion criteria. The prevalence of Pap testing ranged from 4.6%-73%. Having a female provider and access to primary care facilitated Pap testing. Barriers to Pap testing included low income, male healthcare providers, and no history of gynecological exam.

Conclusions: Healthcare providers and social determinants-particularly income and healthcare access, play an important role in improving Pap testing among AI women. Larger studies are needed to explore other important determinants of Pap testing such disease knowledge, self-efficacy, health literacy to reduce the burden of cervical cancer among AI women.

Keywords: African immigrants, cervical cancer, Pap smear, systematic review
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Keywords: African immigrants, cervical cancer, Pap smear, systematic review

INTRODUCTION

Recent cervical cancer screening guidelines recommend Papanicolaou (Pap) testing in addition to human papillomavirus (HPV) co-testing for early detection of precancerous cervical lesions. Pap testing, however, remains the primary method of cervical cancer screening in many countries [1]. Although cervical cancer is preventable and treatable, a large number of women still develop this disease and suffer severe health outcomes [2]. Sub-Saharan Africa has the highest rate of cervical cancer-related mortality, with over 68,000 women dying each year and a large number of cases remaining undiagnosed [3], [4]. Despite this high disease burden, sub-Saharan African women report low rates of Pap testing [4]. Some studies have identified the lack of access to adequate screening programs, underutilization of available screening services, and poor knowledge of cervical cancer risk as barriers to screening among African women living in Africa [5]–[7].

The substantial presence of immigrants influences the epidemiology of diseases in host countries [8]. Over the past two to three decades, war and economic hardship has resulted in many sub-Saharan Africans migrating to developed countries such as the United States (U.S.), Canada, Australia, and western European nations to seek asylum and economic opportunities [9]–[11]. Presently, the largest number of Africans living in developed countries migrate from West and East Africa, where the incidence of cervical cancer is 41.9 cases per 100,000 people compared to 0.4 cases per 100,000 people recorded in North America, Australia and Europe [4], [10], [12]. Although limited, studies have shown that African immigrant (AI) women living in most developed countries also report lower Pap testing rates in comparison to other racial and ethnic minority groups in the host country [6], [13].

The global pattern of migration has increased the number of diverse, ethnocultural populations in many developed countries [10], [14]. Studies on cancer prevention among ethnic/racial minorities in many developed countries often treat Blacks (African immigrants, Afro-Caribbean, and native-born Blacks) as a homogenous group even when evidence shows that the health behaviors (i.e. cancer screening) of these various subgroups are impacted by diverse cultural, structural, and socio-demographic factors [15]–[17]. Studies have also shown that among Blacks, African immigrants record the lowest cancer screening rates and also suffer the worst cancer outcomes [16], [18]. The objective of this systematic review is to critically evaluate existing studies on the prevalence of Pap test screening among AI women in developed countries, and address the factors influencing their Pap testing behaviors.

METHODS

This study is a systematic review and contains no primary, identifiable data so ethical approval was waived by an academic institutional review board.

Search strategy

In December 2018, we performed electronic database searches on PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Embase, and Scopus to retrieve peer-reviewed articles in the last 10 years that focused on the prevalence of Pap test screening among AI women. To enhance the breadth of the literature search, we used subject headings and free text searches, and did not limit our search to a specific time frame. The medical subject headings (MeSHs) and key terms used in developing this search strategy included cancer, neoplasm, cervix, cervical, Pap smear, detection, prevention, Africa, African, African immigrant, Blacks, African refugee, emigrants, immigrants, undocumented, unaccompanied (see Appendix 1 for search strategy). All MeSH terms were exploded and truncated to retrieve as many relevant

articles as possible. The reference lists of relevant articles were examined for articles that were not indexed by the electronic databases used.

Eligibility criteria

Studies were included in this review if they met the following criteria: (1) Included African-born immigrant participants; (2) Published in English; (3) Addressed the prevalence of Pap testing; and (4) Identified correlates of Pap testing behavior. We excluded literature reviews, case studies, articles not published in English, studies that reported correlates of Pap testing but did not address Pap testing prevalence, and studies that did not specify cancer type or include an African immigrant sample. For this review, Pap testing behavior was described as the uptake of a Papanicolaou test (i.e., lifetime screening; adherence to screening guidelines).

Study selection and data extraction

We used Covidence[®], a systematic review management software for the study selection and extraction processes. The initial database search yielded a total of 222 articles and 88 duplicates were removed. Two reviewers independently screened 134 abstracts and titles for relevance and reviewed the full text of 28 articles using the study's inclusion and exclusion criteria. Twelve studies were excluded for the following reasons: (i) No African immigrants (n=2); (ii) No Pap testing (n=5); (iii) No full text available (n=2); (iv) No prevalence of Pap testing reported (n=2); and (v) Article not in English (n=1). The authors met in person to discuss and resolve all conflicts and discrepancies. The flow chart of study selection is shown in Figure 1.

We extracted data from a total of 16 eligible studies and assessed the rigor of the evidence extracted by summarizing studies' purposes, designs, sample sizes, sampling, and key findings.

Quality assessment

Two reviewers independently performed a quality assessment of each study and met to discuss and resolve any conflicts that arose. We used The Joanne Briggs Checklist for assessing studies' quality [19]. Specifically, each study's quality was assessed using items that address selection bias, measurement bias, confounding variables, and appropriate use of statistical analyses [19]. For each criterion, we assigned a score of 1 for items that were adequately described, and a score of 0 for items which were not, with possible scores ranging from 0 to 7. Studies with a total score of less than 3 received a low-quality rating, medium quality was assigned to studies with total scores ranging from 3-4 and studies with total scores ≥ 5 were rated high quality.

All but four studies [20]–[23] adequately described inclusion criteria and the characteristics of study participants. There was adequate discussion of selection bias in most studies included in the review: Description of inclusion criteria (n=15); and description of study characteristics (n=15). However, most studies included in the review did not adequately address measurement bias: lack of identification of confounders (n=10); and no discussion of strategy addressing confounders (n=14). Further, the measurement of outcomes (i.e., Pap testing) in 63% of the studies (n=10) was based on self-reports. Overall, most studies had medium (n=3) to high (n=12) quality ratings. Only one study had a low-quality rating.

RESULTS

Overview of studies

The characteristics of studies selected for this review are summarized in **Table 2**. All sixteen independent studies included in this review were published within the last ten years and were conducted in the following countries: U.S. (n=6)[20], [22], [24]–[27], Canada (n=2),[28], [29], Spain (n=2)[30], [31], Italy (n=2) [23], [32], Australia (n=1) [33], Malaysia (n=1) [34], Finland (n=1) [35], and Norway (n=1) [21]. Most studies (n=12) used a cross-sectional design

and the remaining used retrospective cohort (n=2) [28], [29], mixed methods (n=1) [27] and randomized controlled trial (n=1) designs [25]. All 16 studies used several data sources and recruitment strategies: epidemiological databases (n=10)[20]–[23], [26], [28]–[31], [35], ethnic churches and community-based organizations (n=3)[32], [34], [36], medical records (n=2) [24], [27], and clinics (n=1)[25]. In the U.S., the National Health Interview Survey was the most commonly used epidemiological database [20], [22]. Study participants' ages ranged from 18 years to 75 years, and the sample size of African immigrant participants ranged from 63 to 1,610,875. Only one study[20] used a theoretical model (Anderson Behavioral Model) to guide the selection of study variables. Out of the six studies conducted in the U.S., only four studies[20], [24], [25], [27] delineated participants' countries of origin and they consisted primarily of Somalis. Half of the studies included in the review compared Pap test screening behaviors among multiple immigrant groups [21], [23], [27], [30]–[32], [35], [36].

Prevalence of Pap test screening

Ten of the studies [20], [22], [26]–[28], [30], [32], [34]–[36], based participants' Pap test status on self-report; three studies[21], [24], [25] used medical records, and the remaining studies (n=3)[23], [29], [31] did not report how Pap testing status was determined. The operationalization of adherence to Pap testing ranged from yearly[21], [30] to once in a lifetime [20], [22], [26]. Overall, the prevalence of Pap testing in the preceding one to three years ranged from 4.6% to 59.0% [21], [29], [30] prevalence within a five-year period was 34.7% [35] and Pap test screening prevalence over a lifetime ranged from 52% to 73% [20], [22].

Out of the 16 studies included in this review, seven studies [21]–[23], [26], [27], [32], [35] reported lower prevalence of Pap testing (4.6%-73.%) among AI women in comparison to a higher Pap testing prevalence (7.7%-94%) among other native-born (i.e. African American,

Norwegian, Spaniard, Italian) and immigrant (i.e. Asian, Hispanic, Eastern European) groups. In the U.S., three studies showed that AI women report lower Pap testing prevalence in comparison to African Americans[26], Asians[27] and other foreign-born immigrants (nationality not specified) [22]. Out of these three studies, only one study reported significant associations between women self-identifying as African immigrants and a decreased likelihood of ever receiving a Pap test [26].

Correlates of Pap testing

The Andersen Behavioral Model (ABM) is a multilevel model that identifies individual and contextual determinants (predisposing, enabling, and needs factors) of health behaviors and health services use [37]. In this study, the ABM was used to synthesize extracted study information, and describe the correlates of Pap testing among AI women (see Table 3).

Predisposing factors

According to the Anderson Behavioral Model, predisposing factors are the sociodemographic, cognitive, and cultural determinants of Pap testing [37], [38]. Many studies explored the sociodemographic determinants of Pap testing including age (n=8) [20]–[24], [28], [30], [32], length of stay in the host country (n=7)[20]–[22], [25], [27], [28], [32], marital status (n=5) [21]–[23], [26], [34], education (n=4) [20], [26], [28], [30], immigration status (n=3) [23], [32], [36], employment (n=2) [20], [36], language proficiency (n=5) [23], [27], [28], [30], [32], religion (n=3) [29], [35], [36] and parity (having children) (n=1) [36].

Two studies [23], [28] which used population-based data identified a significant association between age and Pap testing, with middle-aged women (35-49 years) reporting an increased likelihood of Pap testing compared to younger (18-34 years) and older women (≥ 50 years)[23], [28]. Being married [23], [26], [34] and an established immigrant (length of stay > 5

years) [20], [22], [25], [32] were significantly associated with increased Pap testing. One Norwegian study[21] with AI women who were predominantly unmarried, low income, and poorly educated reported significantly lower odds of Pap testing (OR: 0.74, CI: 0.59-0.92) among those who had lived in Norway for more than two years after controlling for sociodemographic variables (age, income, education, marital status, gender of healthcare provider, urban residence) . Of the three studies[29], [35], [36] that assessed religion as a predisposing factor, only one [29] reported a significantly lower rate of Pap testing among Muslim women compared to non-Muslims (adjusted relative risk: 0.77 95% CI: 0.76-0.79) after controlling for other covariates (age, income, English proficiency, insurance). There were no associations reported among employment, language proficiency, immigration status, education, parity, and Pap testing. One study [28], however, reported a higher prevalence of Pap testing among women who migrated as refugees (56%) compared to women who migrated for economic reasons (45%).

Several studies explored cognitive (i.e. cervical cancer knowledge) [32], [34], [36] and cultural (i.e. attitudes towards cancer) [23] variables which may predispose AI women to Pap testing. Two community-based studies that recruited participants from ethnic churches and community organizations reported significant associations between high cervical cancer knowledge and women's receipt of a Pap test [34], [36]. There was no relationship identified between women's attitudes towards cancer and their receipt of a Pap test, however.

Enabling factors

Enabling factors include resources and skills that facilitate or impede the occurrence of Pap testing [37], [38]. Majority of studies assessed income (n=4) [21], [26], [29], [30], health insurance coverage (n=4) [20], [22], [26], [32], health service affordability (n=1) [29], having

primary healthcare (n=8), [21], [24], [27]–[29], [34]–[36] healthcare access (n=3) [24], [35], [36], regular place of residence (n=1) [35], and gender of healthcare provider (n=5)[21], [24], [27]–[29] as enablers of Pap testing among AI women.

Although half of the studies (n=8)[21], [24], [27]–[29], [34]–[36] hypothesized having a primary healthcare provider as a facilitator of Pap testing, only four studies[28], [34]–[36] reported significant relationships between Pap testing and access to primary health care. The gender of healthcare providers played a critical role in AI women's receipt of Pap testing; of five studies [21], [24], [27]–[29] in which an association between female providers and Pap test receipt among AI women was explored, all but one study[29] found a significant association even after controlling for possible confounders (age, income, education, length of stay, employment). Only one US- based study[26] that included a small AI sample (n=36) reported a significant association between high income and a low likelihood of Pap testing (OR=0.18, 95% CI: 0.17-0.19). Two[20], [26] out of the four studies[20], [22], [26], [32] which assessed the relationship between health insurance coverage and Pap testing reported that having no health insurance coverage was associated with a lower likelihood of Pap testing. However, the covariates the researchers controlled for were not explicitly stated.

Needs Factors

Need factors describe how individuals' perceptions of their health and the objective measurements of people's health statuses impact their health behaviors [39]. Perceived susceptibility to cervical cancer [32], [36], perceived health status [20], [30], information sharing [25], preferred way of learning [27], the presence of comorbidities [22], [30], and the perceived barriers to Pap testing [27], [34] were the commonly assessed needs factors. Two studies[32], [36] which reported no associations between women's perceived susceptibility to

cervical cancer and their receipt of a Pap test included predominantly (>50%) married, low educated women with children [32], [36]. One study[25] showed that women who reported talking to their friends and family about cervical cancer were three times more likely to report receiving a Pap test; however, this relationship was not statistically significant. Also, there were no significant associations identified among women's preferred way of learning (written information in one's primary language), perceived health status, and Pap testing [20], [27], [30]. Out of two studies[27], [34] which examined the impact of perceived barriers to screening on women's receipt of a Pap test, only one study[34] with a relatively large sample of AI women (n=320) reported a significant association (OR: 3.11, 95% CI: 2.46-6.43) between low perceived barriers and the increased likelihood of Pap testing after controlling for demographic variables.

DISCUSSION

This systematic review examines the prevalence of Pap testing, and factors that impact the Pap testing behaviors of AI women living in developed nations. The evidence from this review demonstrated a low prevalence of Pap testing among AI women, which is consistent with previous findings on the suboptimal Pap test screening behaviors of AI women in comparison to other ethnic/racial minority groups [16]. The prevalence of Pap testing (ranging from 4.6%-73%) reported in this review were based on women's self-reported receipt of Pap tests. Previous studies have shown that self-reported Pap testing rates are overestimated and often vary from Pap test rates that are based on medical records [40]. Our findings also suggest that having access to a primary care provider and female gender of the provider facilitate Pap testing among AI women. In contrast, evidence from more than one study showed that low income[20], [26] and no history of gynecological exam (i.e. first time screeners)[23], [24], [35] were barriers to Pap testing.

Although the population of Africans migrating to developed countries continues to rise exponentially, AIs are still an underrepresented group in cancer-related research [8], [16]. Out of ten studies[20]–[23], [26], [28]–[31], [35] in this review that used large, population-based data, AI women constituted less than 5% of the total sample sizes in 7 studies [21]–[23], [26], [30], [31], [35]. Most U.S. based studies—which accounted for more than one third of the studies included in the review— included predominately married, English speaking, Somali, urban dwelling, and established immigrants (length of stay > 5 years) with health insurance. As a result, this review lacks evidence on the Pap testing behaviors of recent immigrants with low English proficiency who may have difficulty navigating the U.S. healthcare system due to language barriers or a lack of health insurance. Future cancer prevention and health promotion research involving AI women should include recent immigrants and individuals from different African countries with varying education levels, English proficiencies and health insurance coverage.

LIMITATIONS

The studies included in this review had various limitations that may have contributed to the inconsistent findings we reported. First, only one study[20] used theory to guide the selection and operationalization of study variables, this limits the generalizability of findings. Studies[29], [35], [36] which explored the relationship between religion and Pap testing used participants' place of birth as a proxy measure for religion. This may have resulted in the incorrect identification of study participants because being from an Islam-dominated country does not automatically make an individual a Muslim. The variations in Pap testing prevalence among AI women reported in this review may be the result of differences in national screening guidelines in each country. For instance, in the U.S., routine Pap testing is limited to every three

years for women 21-65 years whereas in Australia it is every 2 years for women aged 25-74 years [41], [42]. Findings from this review showed a dearth of research addressing the impact that known psychosocial factors such as worry, social support, decisional balance, and self-efficacy have on AI women's Pap testing behaviors [16], [43], [44]. Low health literacy is a known predictor of immigrant individuals' underutilization of preventative healthcare, and their overall cancer-related outcomes [45], [46]. However, this concept was not addressed in any of the 16 studies included in this review. None of the studies reported on the psychometrics of measurement tools, therefore delimiting our ability to establish the validity and reliability of the instruments used. Furthermore, only one of the 16 studies [34] conducted an a priori power analysis to determine the appropriate study sample size, so it is possible that the rest of the studies were underpowered.

IMPLICATIONS

Our study findings indicate the need for theory-guided, methodologically rigorous studies that use psychometrically tested instruments, utilize various forms of recruitment strategies (i.e. engage ethnic churches and organizations), and include larger samples of diverse groups of African immigrants (i.e. different African nationalities) to address the Pap testing behaviors and cancer health needs of AI women. To effectively create targeted cervical cancer prevention interventions for AI women, data on Blacks in developed countries should be disaggregated. Researchers need to explore other important determinants of Pap testing such as cervical cancer knowledge, decisional balance, self-efficacy and health literacy in relation to Pap testing among AI women. Further research is also needed to help clinicians understand why male healthcare providers may pose as barriers to Pap testing among AI women living in developed countries.

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COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest: The authors declare no conflicts of interest

Research involving human participants and/or animals: This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent: This study is a systematic review where no identifiable, personal data was gathered. Therefore, obtaining informed consents was not applicable.

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Figure 1: Review and selection process

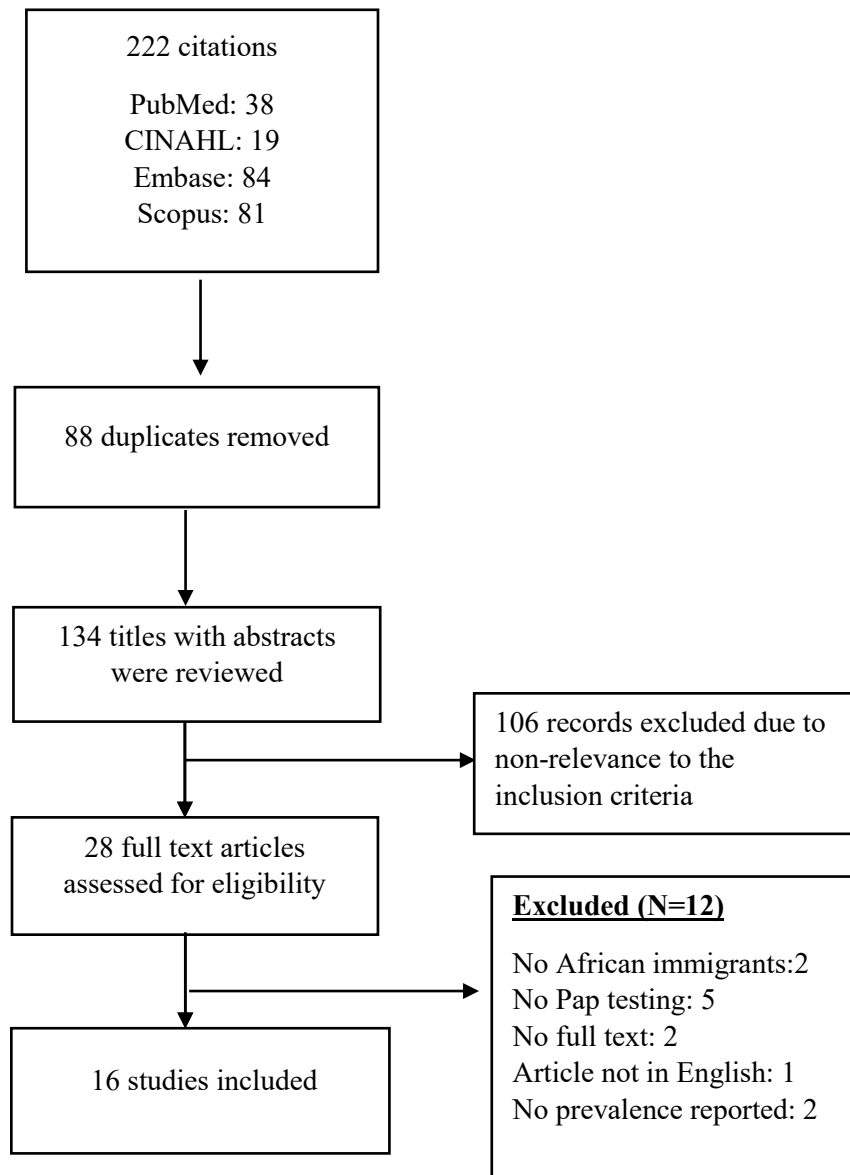


Table 1: Quality assessment of studies (N=16)

1 st author (Year)	Description of inclusion criteria	Description of study characteristics	Standard criteria used for measurement of the condition	Identification of confounders	Strategy for addressing confounding	Valid and reliable measurement of outcome*	Statistical analyses	Overall quality
Anaman (2017)	1	1	1	0	1	0	1	High
Bianco (2017)	1	1	1	0	0	0	1	Medium
Forney-Gorman (2016)	1	1	1	0	0	0	1	Medium
Gallo (2017)	1	0	1	1	1	1	1	High
Harcourt (2014)	0	1	1	0	1	0	1	Medium
Idehen (2017)	1	1	0	1	1	1	1	High
Lofters (2017)	1	1	0	0	0	0	1	Low
Lofters (2011)	1	1	0	1	1	0	1	High
Moen (2017)	0	1	1	1	1	1	1	High
Morrison (2013)	1	1	0	1	1	1	1	High
Nwabichie (2017)	1	1	1	1	1	0	1	High
Rodriguez-Sales (2013)	1	1	1	0	0	1	1	High
Samuel (2009)	1	1	0	1	1	0	1	High
Sanz-Barbero (2011)	1	1	1	1	1	0	1	High
Sewali (2015)	1	1	1	1	1	1	1	High
Tsui (2007)	0	1	1	1	1	0	1	High

*Valid and reliable measurement of outcome: self-reported receipt of Pap test=0; medical records=1

Table 2: Description of study characteristics

1st author (Year), Country	Study Design, Sample size	Study purpose	Sampling	Key Findings
Anaman (2017), Australia	Cross- sectional, N=254	Compare cervical screening uptake between refugee and non-refugee AI women and examine factors associated with Pap smear testing	Convenience sample of refugee and non- refugee urban dwelling African women recruited from African churches, shopping centers and community gatherings Mean age/range: 31y / 21-62y Education: 49% < HS Religion: 89% Christian Employment: 72% employed: Length of stay: 29% less than 5y Marital status: 52% married Parity: 38% no children: Healthcare access: 87% primary care	67% of AI women received pap smear in Australia. Top reasons for Pap testing: Physician recommendation (38%); Receipt of national invitation letter (42%). 74% of women received pap test in ≤ 24 months. Immigrant status is not significantly associated with Pap testing after controlling for other covariates (not specified). Working-full time, being married, having children and visited healthcare provider within 2 years are significant predictors of Pap testing ($p < 0.05$). Cervical cancer knowledge and perceived susceptibility significantly associated with Pap testing after controlling for covariates.
Bianco (2017), Italy	Cross- sectional, N=419	Explore breast and cervical cancer screening participation to acquire information regarding access to healthcare services during pregnancy, childbirth and postpartum period	Immigrant women recruited from non-profit organizations that provide healthcare navigation assistance to immigrants. Mean age/range: 41y / 26-64y Education: 59% HS educated Marital status: 58% married Parity: 75% have children; Employment status: 32% unemployed Immigration status: 90% legal residents Nationality: 46% European, 35% African, 21% Asian, 3% American	45% of AI women received Pap testing within 3years compared to 39% European, 27% Asian and 77% American immigrants. Longer duration of stay in Italy significantly associated with routine pap test (OR: 1.60, $p < 0.001$). In comparison to Europeans, African women are 26% less likely (OR: 0.74) to have received a Pap in past 3 years ($p > 0.41$)

Forney-Gorman (2016), USA	Cross-sectional, N=959	Describe likelihood of having a current Pap smear	<p>Females who completed national health surveys between 2008 and 2010</p> <p>Age range: 21-64y</p> <p>African American (n=620): Marital status: 76% not married Education: 57% HS graduate Income: 32% below federal poverty level Insurance rate: 33% uninsured</p> <p>African (n=36) Marital status: 54% not married Education: 65% HS graduate Income: 24% below federal poverty level Insurance rate: 56% uninsured</p>	<p>55.4% of African Americans and 26.4% of African women reported receipt of Pap test. African American women are 3 times more likely to have reported a current Pap smear than African women (OR = 3.37, p<0.05) after controlling for income, age, education, health insurance, marital status.</p> <p>Higher education associated with higher odds of receiving a Pap among African-born women (OR=1.14, 95% CI: 0.42-3.10). 1 unit increase in income category associated with decreased odds of Pap testing among African-born women (OR=0.18, 95% CI: 0.17-0.19)</p>
Gallo (2017), Italy	Cross-sectional, N=1,610,875	Test the differences in cervical cancer screening among Italian women and immigrants from low- and high-income countries and quantitatively analyze the association of socio-demographic factors with access to cervical cancer screening preventive tests	<p>Women who received invitations to participate in cervical cancer screening in Piedmont, Italy between 2001 and 2013</p> <p>Age range: 25-64y Ethnicity/Race: 2% Africans, 89% Italians, 5% Central & Eastern Europeans; 2% Central and Southern Americans; 0.7% Asians; 2% Education: not reported Marital status: not reported Income: not reported Insurance rate: not reported</p>	<p>41.79% of Africans who received invitations participated in cervical cancer screening compared to 35% Asian and 48.67% Italians.</p> <p>Among foreign-born women, Africans were the least likely to be screened. Older participants less likely to screen than younger ones (P<0.0001). Sociodemographic factors which negatively influenced screening included illiteracy (OR: 0.75, 95% CI: 0.68-0.83), Single (OR: 0.71, 95% CI: 0.69-0.73), First time screening (OR: 0.67, 95% CI: 0.65-0.70)</p>
Harcourt (2014), USA	Cross-sectional, N=421	Determine rates of participation in breast and cervical cancer screening among age eligible African immigrants	<p>Urban-dwelling women in Minnesota, US, who completed the New Americans Community Services survey between 2006-2007</p> <p>Mean age: 34y Ethnicity: 43% Somali; 57% Other African immigrant groups Education: 55% <HS education Length of stay: 70% greater than 5y English proficiency: 51% non-English speakers Employment: 60% employed Insurance rate: 56% difficulty paying insurance</p>	<p>52% reported ever receiving a Pap test. No association among age, level of education, perceived health status and Pap testing. Lower odds of Pap testing associated with unemployment, length of stay (<5 years), difficulty paying health insurance and being Somalian. Recent immigrants (≤5 years) have significantly lower odds of Pap testing history than established immigrants (>5years) (OR=0.40, p<0.001). Being Somali (p=0.08), lived in the US >5 years (p<0.001), unemployed (p=0.01) and difficulty paying health insurance (p=0.09) less likely to receive Pap</p>

Idehen (2017), Finland	Cross-sectional, N=620	Explore factors associated with cervical screening participation among women of Russian, Somali and Kurdish origin	<p>Women who completed health surveys between 2010-2012</p> <p>Age range: 25-60y Nationality: 21% Somali; 47% Russian (n=291); 32% Kurdish (n=199)</p> <p>Somali participants (n=130) Mean age: 39y Age of migration: 28y; Education: 14% HS educated Religion: 99% Muslim Employment: 30% employed</p>	34.7% of Somali women reported history of cervical screening. Increased odds of Pap testing if women have history of at least 1 general health exam (OR=2.58, $p<0.025$), and a gynecological checkup in the past 5 years (6.54, $p<0.001$). Women living outside metropolitan area are less likely to receive a Pap (OR = 0.15, $p=0.035$)
Lofters (2017), Canada	Retrospective cohort, N=52,963	Explore the relationship between religion and cervical cancer screening	<p>Sub-Saharan African immigrant women enrolled in universal health insurance coverage program in Ontario between April 2012-March 2015</p> <p><i>Muslim</i> (n=13,218) Mean age: 38y Income: 38% low income Healthcare access: 17% no primary care English proficiency: 62% English proficient</p> <p><i>Non-Muslim</i> (n=39,745) Mean age: 39y Income: 38% low income Healthcare access: 11% no primary care English proficiency: 71% English proficient</p>	<p>Overdue for cervical cancer screening: 59% of sub-Saharan African women from Muslim majority countries; 45% of sub-Saharan women from non-Muslim majority countries.</p> <p>Being born in a Muslim-majority country associated with significant decrease in likelihood of screening (aRR=0.77, 95% CI: 0.76-0.79); Income not associated with screening; No primary care associated with lower likelihood of screening (aRR=0.40, 95% CI: 0.35-0.46); Not having female physician, using fee for service model associated with lower likelihood of Pap testing</p>
Lofters (2011), Canada	Retrospective cohort, N=26,125	Determine how predictors of low cervical cancer screening varied by region of origin	<p>Sub-Saharan African women in Ontario eligible for health coverage from January 2006-December 2008</p> <p>Mean age/range: 37y / 18-66y Mean age of migration: 25y Immigration status: 38% refugees Income: 45% low income Education: 9% college educated Residence: 97% urban dwelling English proficiency: 72% English speakers;</p>	No significant relative risks of screening identified; no modifiers identified. 52% women between 18-34y, 45% between 35-49y and 53% between 50-66y reported no Pap testing. Being 18-34 years (aRR=1.21, CI: 1.17-1.25) and 50-66y (aRR=1.30, CI: 1.02-1.17) with increased risk of reporting no Pap testing; Having male provider associated with increased risk of non-screening (aRR: 1.33, CI: 1.27-1.39)

Moen (2017), Norway	Cross-sectional, N=1,321,632	Compare the prevalence of Pap testing between immigrant and nonimmigrant groups and study the predictors of attendance to cervical cancer screening programs	National data of Norwegian born and immigrant women eligible for cervical cancer screening in 2008 <i>African immigrants (n=14,008):</i> Mean age: 37y; Income: 73% low income Education: 82% <HS education Residence: 85% urban dwellers Marital status: 55% unmarried Healthcare providers: 38% female providers	4.6% of Africans received Pap; African immigrant women had lower odds of Pap testing in comparison to Norwegian born women (OR = 0.61, 95% CI: 0.56-0.67) Increased odds of Pap testing if female physician (aOR: 1.50, CI: 1.27-1.77); Decreased odds of testing if stayed in Norway over 2 years (aOR: 0.74, CI: 0.59-0.92); No significant association between age, marital status, income, nationality/race of physician and Pap testing
Morrison (2013), USA	Cross-sectional, N=310	Examine clinical and administrative data associated with cervical screening adherence	Medical records of Somali women who attend primary care clinics between January 2006-December 2008 Age range: 18-65y [no other demographic variables reported]	Significant positive association between screening adherence and number of primary care visits, ER visits and OB/GYN visits; 51% women adherent to screening guidelines (every 3 years); Older women more likely to be adherent to screening after controlling for pregnancy; Significant odds of Pap testing when provider is female (OR = 5.9, 95% CI: 3.11-11.8)
Nwabichie (2017), Malaysia	Cross-sectional, N=320	Identify the cervical cancer screening practices and factors affecting the screening status of AI women attended selected church services	Random sample of African women attending churches in Klang Valley Age range: 18-69 years Marital status: 70.6% married; 28.8% single, 0.6% widowed Education: 0.3% <HS; 13.8% HS; 85% College Insurance rate: 88% Insure Nationality: 50% Nigeria; 15% Ghana; 35% Other African countries	27.2% prevalence of Pap testing since the past 3 years; 68.4% had never heard of a Pap test and only 9.7% know that HPV causes cervical cancer. Being married (AOR: 2.26, CI: 1.006-4.361), high cancer knowledge (AOR: 3.22, CI: 1.027-6.216), having a regular physician (AOR: 2.693, CI: 1.001-4.062) are associated with Pap testing. Low perceived barriers (AOR: 3.110, CI: 2.46-6.43) are likely to get screened.
Rodriguez-Sales (2013), Spain	Cross-sectional, N=506,189	Examine cervical cancer screening coverage and prevalence of cytology abnormalities among Catalonia by immigrant status	Spanish or immigrant women registered to receive healthcare services Mean age/range: 42y / 25-65y [no other demographic variables reported]	Out of 7,931 sub-Saharan African women who were eligible, 3284 had received at least 1 Pap smear between 2008-2011

Samuel (2009), USA	Mixed methods, N=100	Assess breast, cervical and colorectal cancer screening rates among immigrant women in the U.S and explore barriers to screening	<p>Random selection of patient medical charts from immigrant (Vietnamese, Cambodian and Somali) women receiving care at a healthcare center</p> <p><i>African immigrants</i> (n= 35) Mean age/range: 59y / 50-75y Average length of stay: 5.5y Education: Not specified Employment: Not specified Income: Not specified Insurance rate: not specified</p>	70% of Somali women received Pap compared to 85% Cambodian and 75% Vietnamese; no statistically significant factors identified.
Sanz-Barbero (2011), Spain	Cross-sectional, N=13,422	Assess the association between geographic origin and the use of screening cervical smears and mammogram	<p>Women who completed the 2006 Spanish National Health Survey</p> <p>Overall data: Mean age/range: 43y / 16-74y Nationality: 86% Spain, 7.4% Central and South America; 2.3% Eastern Europe; 2% Canada, U.S and Western Europe; 1.7% Africa and 0.5% Asia</p> <p><i>African immigrants</i> (n=226): Mean age: 33y Education: 23% Illiterate Employment: Not specified Insurance status: 100% insured</p>	20% of Africans between 16-64y reported receiving a Pap (lowest number) in the past year; compared to 47% Spanish women, 33% Asians and 48% Central/South American. In comparison to the Spanish population, African women were less likely to have received a Pap (OR: 0.47 CI: 0.33-0.67) after adjusting for age, socioeconomic indicators (income, education, social class), self-perceived health, state of health (presence of comorbidities) and healthcare coverage
Sewali (2015), USA	Randomized controlled trial, N=63	Examine difference in successful test completion rates between home-based HPV and clinic-based Pap tests among Somali women	<p>Urban dwelling Somali women overdue for a Pap randomized to a home-based HPV testing group or clinic-based Pap testing group (standard of care)</p> <p>Mean age/range: 55y / 25-70y Nationality: 100% Somali; Length of stay: ≤ 10 years Education: 40% no formal education</p>	Women in the home group were 14 times more likely to complete screening after adjusting for time since last Pap, talking to friends/family about cancer screening, length of stay in the U.S (OR: 14.18, CI: 2.73-73.51; $p=0.002$). Women who reported talking to friends/family are 3 times more likely to complete screening (OR: 3.14, 95% CI: 0.72-13.67; $p=0.127$); although not statistically significant. Odds of Pap testing increased significantly for every 1 year of stay in the U.S Women who have lived longer in the US are more likely to complete screening ($p < 0.011$). Out of 32 (n=26) women who did self-sampling, 83% reported acceptability

Tsui (2007), USA	Cross-sectional, N=70,775	Assess cervical cancer screening rates among foreign-born women by birthplace and duration of stay in the U. S	<p>Women who completed the National Health Interview Surveys (1998, 1999, 2000 and 2003)</p> <p><i>Data on foreign-born participants (n=9863)</i></p> <p>Age range: 18-70y</p> <p>Immigration status: 70% recent immigrants</p> <p>Marital status: 66% married</p> <p>Education: 8% <HS</p> <p>Income: 5% below poverty level</p> <p>Insurance rate: 30% uninsured</p> <p>Healthcare access: 20% no primary care provider</p>	<p>Only 2% of foreign-born study participants were African immigrants (n=197). 18% of recent African immigrants had never screened vs. 8.4% of established residents; Significant differences ($p<0.001$) in unscreened rates between U.S born and foreign-born women by length of stay after adjusting for confounders (age, race, marital status, region of residence, income, insurance, smoking status). 26.4% of Africans had never screened for cervical cancer with 8.4% of them being established immigrants and 18% being recent immigrants</p>
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aOR: adjusted odds ratio, OR: odds ratio; aRR: adjusted relative risk; RR: relative risk; HS: High school

Table 3: Predisposing, enabling and needs factors associated with Pap testing among AI women

1st author (Year)	Predisposing Factors	Enabling Factors	Needs Factors	Study Outcome
Anaman (2017)	Employment (full-time), Being married, Cervical cancer knowledge, Having children, Immigration status	Health care visit within 2 years	Perceived susceptibility	Pap testing within 2 years
Bianco (2017)	Length of stay, Cancer knowledge, Legal residence (immigration status), Language	Health insurance	Perceived susceptibility	Pap testing within past 3 years
Forney-Gorman (2016)	Education, Marital status	Health insurance, Income	--	Lifetime receipt of a Pap smear
Gallo (2017)	Attitude toward cancer Age, Illiteracy (English proficiency), Marital status First time screener	--	--	Pap smear receipt between 2001-2013
Harcourt (2014)	Age, Education, Employment Length of stay	Insurance (difficulty paying)	Perceived health status	Lifetime receipt of a Pap smear
Idehen (2017)	--	History of general exam, Gynecological check-up in past 5 years, Living outside metropolitan area	--	Pap testing within past 5 years
Lofters (2017)	Religion	Having primary healthcare Female physician Income Affordability of healthcare services	--	Pap test within past 3 years
Lofters (2011)	English proficiency, Length of stay Immigration status, Education Age	Female physician	--	Pap test within past 3 years
Moen (2017)	Age, Marital status	Female physician, Nationality/race of physician, Income	--	Pap test receipt within 1 year
Morrison (2013)	Age	Emergency room, primary care and OB/GYN visits Female physician	--	Pap test receipt within 3 years
Nwabichie (2017)	Cervical cancer knowledge Marital status	Regular physician	Perceived barriers (pap smear is painful, worry, lack of female screeners, embarrassment, take away virginity)	Pap test receipt within 3 years

Rodriguez-Sales (2013)	--	--	--	Pap test receipt within 3 years
Samuel et al., 2009	Language, Length of stay	Healthcare cost, Gender of physician	Fear/embarrassment, Preferred way of learning (information written in own language)	<i>Not described</i>
Sanz-Barbero (2011)	Age, Education, Social class, Language	Healthcare coverage, Income	Perceived health state, State of health (presence of comorbidities)	Pap test receipt within 1 year
Sewali (2015)	Length of stay	--	Information sharing (talking to friends/family)	Pap test receipt within 3 years
Tsui (2007)	Length of stay, Age, Race, Marital status, Region of residence	Insurance	Smoking status	Lifetime receipt of a Pap test

Appendix 1: Database search terms

PubMed

("Neoplasms"[Mesh] OR "cancer" OR "cancers" OR neoplasm*)
AND
("Africa"[Mesh] OR "african immigrant" OR "african refugee" OR "african refugees" OR "african immigrants" OR "africans" OR "west africa" OR "west africans" OR "ghana" OR "ghanaian" OR "ghanaians" OR nigeria*)
AND
("Mass Screening"[Mesh] OR "early detection of cancer"[mesh] OR screen* OR "early detection" OR "prevention")
AND
("breast" OR "cervical" OR "uterine" OR "uterus" OR "cervix")
AND
("emigrants and immigrants"[mesh] OR emigrant* OR immigrant* OR migrant* OR "undocumented" OR "unaccompanied")

CINAHL

("Neoplasms" OR "cancer" OR "cancers" OR neoplasm*)
AND
("Africa" OR "african immigrant" OR "african refugee" OR "african refugees" OR "african immigrants" OR "africans" OR "west africa" OR "west africans" OR "ghana" OR "ghanaian" OR "ghanaians" OR nigeria*)
AND
("Mass Screening" OR "early detection of cancer" OR screen* OR "early detection" OR "prevention")
AND
("breast" OR "cervical" OR "uterine" OR "uterus" OR "cervix")
AND
("emigrants and immigrants" OR emigrant* OR immigrant* OR migrant* OR "undocumented" OR "unaccompanied")

Embase

("Neoplasms" OR "cancer" OR "cancers" OR neoplasm*)
AND
("Africa" OR "african immigrant" OR "african refugee" OR "african refugees" OR "african immigrants" OR "africans" OR "west africa" OR "west africans" OR "ghana" OR "ghanaian" OR "ghanaians" OR nigeria*)
AND
("Mass Screening" OR "early detection of cancer" OR screen* OR "early detection" OR "prevention")
AND
("breast" OR "cervical" OR "uterine" OR "uterus" OR "cervix")
AND
("emigrants and immigrants" OR emigrant* OR immigrant* OR migrant* OR "undocumented" OR "unaccompanied")

Scopus

TITLE-ABS-KEY("Neoplasms" OR "cancer" OR "cancers" OR neoplasm*) AND TITLE-ABS-KEY("Africa" OR "african immigrant" OR "african refugee" OR "african refugees" OR "african immigrants" OR "africans" OR "west africa" OR "west africans" OR "ghana" OR "ghanaian" OR "ghanaians" OR nigeria*) AND TITLE-ABS-KEY("Mass Screening" OR "early detection of cancer" OR screen* OR "early detection" OR "prevention") AND TITLE-ABS-KEY("breast" OR "cervical" OR "uterine" OR "uterus" OR "cervix") AND TITLE-ABS-KEY("emigrants and immigrants" OR emigrant* OR immigrant* OR migrant* OR "undocumented" OR "unaccompanied")

CHAPTER 4

**Recruiting African immigrant women for community-based cancer prevention studies:
Lessons learned from the AfroPap study**

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Abstract

Background: Recruitment in research can be challenging, particularly for racial/ethnic minorities and immigrants. There remains a dearth of research identifying the health and sociocultural needs of these populations related to recruitment.

Purpose: To describe our experiences and lessons learned in recruiting African immigrant (AI) women for the AfroPap study, a community-based study examining correlates of cervical cancer screening behaviors.

Methods: We developed several recruitment strategies in collaboration with key informants and considered published recruitment methods proven effective in immigrant populations. We also evaluated the various recruitment strategies using recruitment records and study team meeting logs.

Results: We enrolled 167 AI women in the AfroPap study. We used the following recruitment strategies: (1) Mobilizing African churches; (2) Utilizing word of mouth through family and friends; (3) Maximizing research team's cultural competence and gender concordance; (4) Promoting altruism through health education; (5) Ensuring confidentiality through the consenting and data collection processes; and (6) Providing options for data collection. Online recruitment via WhatsApp was an effective recruitment strategy because it built on existing information sharing norms within the community. Fear of confidentiality breaches and time constraints were the most common barriers to recruitment.

Conclusion: We were successful in recruiting a "hard-to-reach" immigrant population in a study to understand the correlates of cervical cancer screening behaviors among AI women by using a variety of recruitment strategies. For future research involving African immigrants, using the internet and social media to recruit participants is a promising strategy to consider.

Keywords: Recruitment strategies; African immigrants; cervical cancer; Pap testing

Introduction

In the United States (U.S.), higher cancer prevalence, poorer cancer prognoses and higher cancer related deaths are pronounced in racial/ethnic, cultural and linguistic minority groups (Gadegbeku et al., 2008; Hinojosa et al., 2014). There are systematic efforts in place to promote the inclusion of racial/ethnic and socioeconomically diverse groups in cancer prevention and health promotion studies, including the incentivization of study participants and researchers in the form of monetary compensations and research grants, respectively (National Institute of Health, 2017). Despite these efforts, recruiting and enrolling participants in cancer prevention and health promotion studies remain challenging, especially when the potential study participants belong to low income, racial/ethnic minority, and immigrant groups (Blanchet et al., 2017; Kerani et al., 2019). Low education, low English proficiency, or certain study topics such as cancer, which is stigmatized in some immigrant, communities may pose additional recruitment challenges (Han, Kang, Kim, Ryu, & Kim, 2007; Maxwell, Bastani, Vida, & Warda, 2005).

Several factors have been identified as barriers to the successful recruitment and enrollment of racial/ethnic minorities in cancer prevention and health promotion studies. The history of research misconduct and human subject abuse that racial/ethnic minorities and persons of low income have experienced in the U.S. has created fear of research and the mistrust of researchers among these vulnerable populations (Pirie & Gute, 2013; Scharff et al., 2010). Immigrants often have limited social and financial resources and thus become hesitant to enroll in research studies because of the fear that any breach of confidentiality could have severe negative economic and social consequences (Kerani et al., 2019). The current political climate has also created concerns among immigrants who fear that, their personal information would be shared with government officials if they participate in research studies, which could lead to

harassment by immigration officials and potential deportation (Boom et al., 2018).

Notwithstanding these barriers, it is important to include racial/ethnic, cultural, and linguistically diverse groups in health research in order to develop effective health interventions to address the health problems that often plague vulnerable populations (Blanchet et al., 2017; Durant et al., 2014; Hinojosa et al., 2014).

While the persistent underrepresentation of racial/ethnic minorities in cancer trials has been well described in the literature, the effective strategies that researchers have used to recruit immigrants for community-based cancer prevention studies are not well documented (Duma et al., 2017; Ford et al., 2008). In the U.S., published studies addressing immigrant recruitment strategies in cancer prevention research have included small sample sizes, focused primarily on Hispanic immigrants, and recruited study participants mainly from community clinics (Diaz et al., 2017). Recruitment strategies employed among African immigrant women in the U.S. are not well-documented. In this paper, we report the recruitment successes and the steps taken to increase the recruitment of African immigrant (AI) women for a community-based cancer prevention study between 2017 and 2018. In addition, we discuss the lessons we learned to inform future studies and facilitate the recruitment of immigrant, low income, low English proficient, and ethnic/racial minorities for community-based, cancer prevention studies.

Methods

Study design

The African immigrant women Pap testing behaviors (AfroPap) study was a community-based, explanatory, mixed-methods study to understand the impact of health literacy, culture, and psychosocial factors on the cervical cancer screening behaviors of AI women in the U.S. The first phase of the study involved the completion of a quantitative survey to assess AI women's

cervical cancer knowledge, health literacy, and other psychosocial determinants (self-efficacy, decisional balance) of Pap testing. The second phase of the study included one-on-one telephone interviews with a subset of survey participants to gain an in-depth understanding of how their health information sharing practices were influenced by their cultural beliefs and health literacy levels. Females who self-identified as African immigrants, were 21 years and older, able to read and write English and had no history of hysterectomy were eligible to enroll in the study. Potential participants were identified via word of mouth, African immigrant churches, and community organizations that provide services to African immigrants. Our initial recruitment goal was 160 AI women residing in the Washington D.C.-Maryland-Virginia (DMV) metropolitan area, a region with a concentration of African immigrants (12%) that is three times the national average (Bureau, 2014). After further review of the literature, we identified that studies in the U.S. that include African immigrants often recruited participants originating from one specific African country (e.g., Somalia, Ghana, or Nigeria) or residing in a specific region of the country (e.g., Minnesota) (Commodore-Mensah, Himmelfarb, Agyemang, & Sumner, 2015; Hurtado-de-Mendoza et al., 2014). In our efforts to expand the study catchment area, we modified our eligibility criteria to include all AI women who reside in the U.S.

Procedure

All study procedures were approved by an academic institutional review board (IRB). Potential participants were approached at various African churches and community organizations where study flyers were disseminated. We piloted the study survey and procedures in October 2017 with 7 participants, and 3 advisory board members (1 Principal investigator of an African immigrant study and 2 African immigrant nurses) to establish our data collection protocol. Trained bilingual research assistants (RAs) obtained informed consent from every participant in

the AfroPap study. Participants were given options to complete the study survey either in-person or online. Study participants received a \$5 gift card after survey completion.

Analysis

Descriptive statistics such as frequencies, percentages, and means were used to calculate yield rates. Content analysis was performed on study team meeting logs to identify common barriers and facilitators to recruitment of AI women for the AfroPap study.

Results

Recruitment yield rates

During a one-year active recruitment period (November 2017-December 2018), we met our goal and enrolled 167 AI women. Forty-six percent of study participants completed the online version of the survey and 54% completed the in-person survey. Online surveys resulted in the highest yield (69.72%) compared to in-person surveys (55.49%); details of the yield rates can be found in Table 1.

Table 2 describes the sociodemographic characteristics of the participants by survey completion method. Women who completed the surveys online were more likely to be college educated (80%), employed (83%), insured (84%), not married (43%) and younger (mean age: 33 years). Women who completed the in-person surveys were more likely to be older (mean age: 46 years) and married (68%).

Strategies to enhance participant recruitment

We adopted a variety of strategies to facilitate participant enrollment. Main strategies included: (1) Mobilizing African immigrant churches; (2) Using an online survey; (3) Utilizing word of mouth through female friends and relatives; (4) Maximizing gender concordance and cultural competence of research team; (5) Promoting altruism through health education; (6)

Ensuring confidentiality through the consenting and data collection process, and (7) Providing options for data collection.

Mobilizing African immigrant churches: Our community advisory board members helped the study team identify African immigrant churches in the Washington-D.C.-Maryland-Virginia area. In addition, our RAs conducted additional Google searches to identify the names and contact information of churches not listed by the advisory board. Among immigrant communities, attending church is a social event, and churches provide social support and a sense of social cohesion to members (Ezeanolue et al., 2015; Katz, Kauffman, Tatum, & Paskett, 2008; Wamai et al., 2012). Previous health studies on African immigrants also successfully used African churches as a primary recruitment site because of the large number of African immigrants who attend church services on a weekly basis (Commodore-Mensah et al., 2015). When recruiting from African churches, we found that an initial contact with the church leadership through phone calls and emails was effective. The principal investigator (PI) also attended church service a week prior to the actual study recruitment/data collection. The introductory visits were helpful because it gave the study team an opportunity to build rapport with the leaders, provide a brief study overview and answer any questions the congregation may have. With approval from the churches' leadership team (pastors, heads of women ministries, church elders, etc.), we distributed study flyers to the congregation, displayed flyers at the church sites, and published study flyers in the churches' newsletters. On the agreed date of recruitment, the team set up tables in a private room on the church premises to answer additional questions about the study and enroll women who were eligible and willing to participate.

Use of online survey: Key informants (female leaders of African community-based organizations and religious institutions) suggested that our target population use WhatsApp, a

social media and telecommunication platform, to disseminate news and health information. Therefore, we created the online study survey using Qualtrics, a web-based survey tool. We chose Qualtrics because it is an encrypted data management system which enhances participants' confidentiality, is easy to use, and provides a unique, shareable weblink to the online survey. The online survey included a copy of the IRB-approved oral consent script and an eligibility self-screening. The online survey was only limited to individuals who could complete the survey on their own with no assistance from the research team. To ensure survey completion, we asked participants who finished the surveys online to provide their contact information at the end of the survey so the research team could contact them for a one-on-one telephone interview (if necessary) and compensate them for their time.

Word-of-mouth through female friends and relatives: Informal, oral communication, and the sharing of health information among female friends and families is a common practice within the African community (Mosavel, 2012; Mosavel & Ports, 2015). With this knowledge, we used word-of-mouth as one of the primary strategies to recruit study participants. Both eligible and ineligible study participants were asked to share information about the study with their close female friends and relatives. The word-of-mouth recruitment strategy evolved to include encouraging study participants to also share the web link of the study survey with other African immigrant females within their social circles.

Gender concordance and cultural competence of research team: When recruiting immigrants and minorities for a study, it is important that the study team exhibits competent knowledge of the target population's cultural norms and values (Han et al., 2007; Kerani et al., 2019; Pirie & Gute, 2013). Our study survey included questions on women's health (example: history of Pap testing, vaginal and reproductive health, etc.), which African women are often

uncomfortable discussing with individuals of the opposite sex, especially if the individual is not their regular healthcare provider (Adegboyega & Hatcher, 2017; Carroll et al., 2007). When addressing a health issue that is gender specific such as cervical cancer screening, it is also essential that the study team is made of members whose gender reflect the target population as well. For AfroPap study, the PI and the study team were first-generation, female African immigrant researchers and staff who spoke English in addition to various African dialects (*Twi, Ga, Igbo, Pidgin English*), and shared an in-depth understanding of life of as female, African immigrants in the United States. This approach enhanced the research team's engagement with study participants and expedited the data collection process for participants who were eligible to enroll in the study but needed additional assistance in completing the study survey due to their limited English proficiency. The research team's demonstration of cultural competence also helped build trust among potential study participants.

Promoting altruism through health education: Studies on African immigrants report low knowledge and low perceived susceptibility as barriers to positive health behaviors such as cervical cancer screening (Ghebre et al., 2015; Nwabichie, Manaf, & Ismail, 2018; Williams, Moneyham, Kempf, Chamot, & Scarinci, 2015). Individuals who lack awareness about cervical cancer and the importance of health promotion are less likely to participate in health promotion related studies because they do not see their value (Craig, Lahey, Dixit, & Fordham Von Reyn, 2018; Han et al., 2007; Kerani et al., 2019). To enhance AI women's participation in the AfroPap study, we provided cervical cancer education sessions at the various churches that served as recruitment sites. We conducted education sessions a week before recruitment in conjunction with our introductory visits. We prepared and delivered a 10-minute presentation where we addressed the following: (1) Description of cervical cancer; (2) Description of Pap

testing; and (3) Importance of cervical cancer screening and early detection to African women. Studies have reported individuals' expectation of personal benefit and altruism as known facilitators to research participation, so during the education sessions, we emphasized the important roles mothers and daughters play in the African family (Craig et al., 2018; Han et al., 2007). We also highlighted how understanding the health and wellbeing of women could ultimately inform health policies to address the health needs of female, African immigrants in the U.S.

Ensuring confidentiality through the consenting and data collection processes: When conducting community-based research with immigrants, it is essential that researchers develop and use consenting and data collection processes that do not make potential study participants feel coerced (Blanchet et al., 2017; Kerani et al., 2019; Maxwell et al., 2005). We initially received IRB approval to enroll study participants using written consents. After an unexpectedly low initial enrollment, we sought the advice of our advisory board and key informants who recommended oral consent as a strategy to address participants' fear of potential confidentiality breach.

Providing options for data completion: Community-based studies that include minorities and use in-person data collection methods often identify time constraint as a main barrier to recruitment and participant engagement (Haley et al., 2017). In order to effectively address this issue in our study, we offered all eligible study participants the following survey options: (1) An in-person paper survey, or (2) An online survey. The identical survey options included questions on demographics, immigration (year of arrival, length of stay), assessment of English proficiency, access to medical care, and history of cervical cancer screening. Well-validated instruments that assessed health literacy, self-efficacy, cervical cancer knowledge, and decisional

balance were also included in the surveys. Both surveys could be completed in approximately 20 minutes. With the online survey option, eligible participants who did not have time to complete an in-person survey still had the opportunity to complete the survey at a time that was convenient for them.

Barriers and facilitators to recruitment

Although we met our recruitment goal, we identified several factors at the organizational and individual levels which served as facilitators and barriers to the successful recruitment of African immigrants for the AfroPap study. Out of twelve African immigrant churches and five community-based organizations we contacted to serve as potential recruitment sites, the study team was able to build collaborative relationships with seven churches and one community organization. The leaders of the sites which declined to collaborate with us cited time constraint as the main barrier because they could not fit a research study into their regular, preplanned schedules. One church declined to participate because our study team was not providing free Pap smears, and the participant incentive of \$5 was “too small.” At the individual-level, concerns with immigration status and signing an informed consent were identified as barriers to recruitment. The major facilitator to recruitment at the individual and organizational levels included building trust and exhibiting cultural competence. Our study team accomplished this by ensuring the racial/gender concordance of the research team, building a rapport with church and community organization leaders who served as gatekeepers, and helping community members understand the importance of research studies and cervical cancer screening by providing health education sessions. To address the issue of time constraints and increase in-person survey completion rates, we provided participants who completed the in-person surveys with prepaid

stamped envelopes so they could mail their completed surveys back to the study team at a later time.

Discussion

This study shows that a diverse sample of AI women can be successfully recruited for a community-based, cancer prevention, and health promotion study. We attribute the success of the AfroPap study to the hard work of our trained research team, proactive principal investigator, key informants/gatekeepers, community advisory board, and study participants who shared information about our study with their peers and encouraged them to join. Most importantly, our successful recruitment can be attributed to the different recruitment strategies we used. Many studies involving Asian and Hispanic immigrants have shown word-of-mouth as an effective recruitment strategy (Hanza et al., 2016; Maxwell et al., 2005; Wang, Sheppard, Liang, Ma, & Maxwell, 2014). What made our efforts different was that we identified and took advantage of preexisting information sharing norms within the African immigrant community. In particular, by encouraging women to use WhatsApp to share information about our study, we were able to tap into the preexisting social bonds of our study participants. This strategy tremendously enhanced our recruitment efforts.

Despite AfroPap study's relatively small sample size, the pattern of migration reported by the study participants is similar to the national distribution of African immigrants living in the U.S. For example, as of 2015, the largest number of African immigrants in the U.S. migrated from West (44.6%) and East (35.7%) Africa, with the most common countries of origin being Nigeria, Ghana, Ethiopia, and Kenya (Zong & Batalova, 2017). For the AfroPap study, the majority of study participants were from West Africa (92%), with the largest number of participants migrating from Ghana (n=106), Nigeria (n=17), and Cameroon (n=27). East

Africans (8%) also made up a small proportion of the sample size. The AfroPap sample characteristics were also like those of national samples. According to the Migration Policy Institute, 35% of sub-Saharan Africans ages 25 and older have a Bachelor's degree (Zong & Batalova, 2017). Individuals with less than a college education and limited English proficiency were underrepresented in our study sample (see Table 2). Thirty-one percent of AfroPap participants reported having less than a college education and 23% had limited English proficiency. Majority of our study participants resided in Virginia (40%), Maryland (28%), and Texas (14%) which is similar to the states with the highest concentrations of African immigrants as reported by the 2015 U.S Census Bureau (Zong & Batalova, 2017).

We learned the importance of performing ongoing assessments of barriers and facilitators to recruitment and modifying recruitment strategies accordingly. We identified written informed consents, time constraints, limited knowledge on cervical cancer and the importance of Pap testing as potential barriers to recruitment. To address these issues, we offered oral consents, provided study participants with an online study survey which could be completed at their convenience as an alternative to completing in-person surveys. We also provided potential study participants with an education session on cervical cancer and Pap testing. Similar to other health studies, we saw an increase in study participation from recruitment sites where participants were engaged during education sessions, and could verbalize how the research study would benefit them and future generations (Craig et al., 2018; Maxwell et al., 2005). Many studies have shown the important contributions that building rapport and establishing collaborative relationships with gatekeepers, using ethnic churches, demonstrating cultural competence and ensuring gender/racial concordance of a research team can make in recruiting immigrants (Asian and Hispanics) for community-based studies (Fryer et al., 2016; Han et al., 2007; Kerani et al., 2019;

Maxwell et al., 2005). In this study, we have shown that building on these known facilitators are essential to successful recruitment of African immigrants.

Conclusion

In summary, the successful recruitment of AI women for the AfroPap study was the result of the synergism of the various recruitment strategies we used. We were able to demonstrate that a sample of African immigrants can be successfully recruited for a community-based research study using a wide array of strategies if the study team constantly monitors and modifies recruitment strategies based on their effectiveness. When working with a linguistically, culturally diverse, AI population, one recruitment strategy may not always fit all. Some studies have shown that older adults and individuals belonging to immigrant groups are less likely to use the internet (Hunsaker & Hargittai, 2018; Selsky, Luta, Mandelblatt, Huerta, & Mandelblatt, 2013). In our study, participant recruitment increased after introducing oral consenting, and distribution of study survey weblink via WhatsApp. In particular, using WhatsApp and online surveys resulted in a high yield. Based on the findings from our study, we highly recommend the use of the internet as an innovative and flexible strategy to recruit African immigrants for future community-based studies.

Conflict of Interest: The authors declare they have no conflict of interest

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Table 1: Recruitment yield per survey type

Survey version	Participants recruited (n)	Participants enrolled (n)	Yield
In-person	164	91	55.49%
Online	109	76	69.72%
Total (N)	273	167	61.17%

Table 2: Description of participants in the AfroPap Study

Characteristics	Overall (N=167)	In-person surveys (N=91)	Online surveys (N=76)
Age, years Mean (SD)	40.90 (12.25)	46.70 (11.27)	33.96 (9.48)
Range	22-65	22-65	22-61
Education			
<HS	19 (11)	17 (19)	2 (3)
High school	34 (20)	31 (23)	13 (17)
College	114 (68)	53 (58)	61 (80)
*English Proficiency (n, %)			
Low	38 (23)	28 (31)	10 (13)
High	129 (77)	63 (69)	66 (87)
Employment (n, %)			
Employed	134 (80)	71 (78)	63 (83)
Unemployed	23 (14)	16 (18)	7 (9)
Other	10 (6)	4 (4)	6 (8)
Health insurance (n, %)			
Yes	132 (79)	68 (75)	64 (84)
No	35 (21)	23 (25)	12 (16)
Marital status (n, %)			
Married	95 (57)	62 (68)	33 (43)
Separated/Divorced	27 (16)	19 (21)	8 (11)
Not married	45 (27)	10 (11)	35 (46)
Length of stay Mean (SD)	15.12 (7.76)	15.91 (8.29)	14.14 (6.99)
<15 years (n, %)	74 (46)	31 (34)	35 (46)
≥15years (n, %)	88 (54)	60 (66)	41 (53)
History of Pap testing (n, %)			
Yes	118 (71)	70 (77)	48 (63)
No	49 (29)	21 (23)	28 (37)
Country of Birth (n, %)			
Ghana	106 (63)	66 (73)	40 (53)
Nigeria	16 (10)	--	16 (21)
Cameroon	27 (16)	24 (26)	3 (4)
Uganda	6 (4)	--	6 (8)
Kenya	4 (2)	--	4 (5)
Other*	8 (5)	1 (1)	7 (9)
State of residence (n)			
Virginia	66 (40)	55 (61)	11 (14)
Maryland	47 (28)	33 (36)	14 (18)
New York	5 (3)	--	5 (7)
Texas	24 (14)	--	24 (32)
New Jersey	5 (3)	--	5 (7)
Other**	20 (12)	3 (3)	17 (22)

⁺ 6-item instrument which assess individuals ability to read, write, converse in English | * Tanzania (n=1), Congo (n=1), Tog(n=1), Cote D'Ivoire (n=2), Sierra Leone (n=2) | Ethiopia (n=1)**Arizona (n=1) , California(n=3), Nevada (n=1), Georgia (2), District of Columbia (n=3), Pennsylvania (n=2), Illinois (n=1), Ohio (n=4), Rhodes Island (n=1), Minnesota (n=1), Michigan (n=1) and Nebraska (n=1)

CHAPTER 5

Exploring health literacy and the correlates of Pap testing among African immigrant women: Findings from the AfroPap study

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ABSTRACT

Background: African immigrant (AI) women have low rates of Pap testing. Health literacy plays a pivotal role in health behaviors. Sources and types of health information could shape health literacy and inform the Pap testing behaviors of AI women. However, the influences of health literacy, sources and types of health information along with cultural and psychosocial correlates on the Pap testing behaviors of AI women are poorly understood.

Objective: To examine how sources and types of health information impact health literacy, and in turn, how health literacy, cultural and psychosocial factors influence the Pap testing behaviors of AI women.

Methods: An adapted Health Literacy Skills Framework guided the selection of variables for this cross-sectional study. Convenience sampling was used to recruit 167 AI women, 21-65 years. Multivariate logistic regression was used to assess correlates of Pap testing after adjusting for covariates (age, education, English proficiency, employment, income, health insurance, access to primary care, marital status, and healthcare provider recommendation).

Results: Most participants (71%) had received a Pap test in the past and used multiple (two or more) sources (65%) and types (57%) of health information. Using multiple sources of health information (aOR: 0.11, $p<0.01$) but not types of health information was associated with Pap testing. Having negative cultural beliefs (aOR:0.17, $p=0.01$) and high self-efficacy (aOR: 9.38, $p<0.01$) were significantly associated with Pap testing after adjusting for covariates. High health literacy (OR: 3.23, $p<0.05$) and high decisional balance (OR: 5.28, $p<0.001$) were associated with Pap testing in bivariate models but did not remain significant after controlling for covariates.

Conclusions: Cultural beliefs was a significant correlate of AI women's Pap testing behaviors regardless of other known social determinants of health (education, English proficiency, age, access to primary care). Disseminating health information through various sources have the potential to promote Pap testing among AI women. Larger studies which utilize a robust sampling strategy and include a diverse group of AI women are needed in order to optimize health interventions aimed at improving Pap test screening behaviors among AI women.

Key terms: Health literacy, Pap testing, African immigrant, women, psychosocial factors

INTRODUCTION

Cervical cancer is preventable, and among those who develop cervical cancer, early detection and treatment results in high survival rates and better health outcomes.¹ In particular, since the Papanicolaou (Pap) test was introduced as the ideal method for early detection of cervical cancer, there has been a substantial decrease in the number of women who die from cervical cancer in the United States (U.S.) each year.² Nevertheless, the American Cancer Society estimates that in 2019, about 13,170 women in the U.S will be diagnosed with cervical cancer and about 4,250 of these women will die from the disease.² Disparities in cervical cancer outcomes persist, particularly among racial/ethnic and immigrant populations. For example, Black women have higher cervical cancer death rates compared to other racial/ethnic groups due, in large part, to lower Pap testing rates.³ Within the Black ethnicity, African immigrant (AI) women (nationally not specified) represent the most vulnerable subgroup of women, having 2-3 times less likelihood of reporting a lifetime receipt of a Pap test in comparison to African American women.^{4,5}

Health literacy is a multi-dimensional concept that addresses the various skillsets a person needs to successfully “obtain, process, understand and use basic health information and services to make appropriate health decisions.”⁶ Health literacy has been reported as a strong determinant of Pap testing in middle-age white women,^{7,8} Asian immigrant women,⁹ and Hispanic immigrant women.^{10,11} None of the studies included AI women, however. Further, prior research assessed health literacy using single domain instruments (i.e., print literacy) such as the Test of Functional Literacy in Adults (TOFHLA) and Rapid Estimate of Adult Literacy in Medicine (REALM), without addressing other skillsets such as navigational literacy (operate effectively in a healthcare setting), familiarity (knowledge and understanding of health

concepts), oral literacy (speaking and listening effectively) and numeracy (appropriate use of quantitative information) which are essential to inform a health behavior such as cancer screening.^{8,12,13}

Sources of health information such as mass media (i.e. television, radio, Internet), social media (i.e. Facebook and WhatsApp) and interpersonal relationships made through friends, family, religious organizations and with healthcare providers are known to influence health behaviors.^{14,15} Within the African cultural context, female friends/family serve as a central portal for the dissemination of women's health information, and hence, may play a crucial role in shaping health literacy and the adoption of health behavior such as cancer screening.^{16–19} The use of different types (verbal, written text, pictures) of health information exchange is also suggested as a possible mechanism through which health literacy is shaped and health behaviors are adopted.^{6,20} For example, a significant number of adults with low health literacy prefer verbal communication to written text.^{21,22}

In addition to health literacy, a number of sociodemographic, cultural, and psychosocial factors have been associated with Pap testing behaviors. For instance, low English proficiency, limited cancer knowledge, low perceived susceptibility and embarrassment were negatively associated with Pap testing behaviors among Asian immigrant women,^{23,24} so were low income, no health insurance coverage, low cancer knowledge, fatalism and embarrassment among African American women.^{25,26} AI women have unique cultural experiences and it is likely that the correlates of Pap testing among this population may differ from those of women belonging to other ethnic/racial and immigrant groups. For example, AI women report higher levels of English proficiency in comparison to certain subgroups of Asian immigrant women (i.e. Chinese and Korean) who often report having difficulty communicating in English.^{27–29} AIs also report

higher perceived incidents of discrimination by healthcare practitioners due to their accents, immigration status and cultural mode of dressing whereas African Americans report age and poverty as the main reasons for higher perceived healthcare-related discrimination.^{30–33}

Taken together, there is limited research addressing health literacy and other correlates in relation to Pap testing behaviors among AI women. Considering that high mortality with low rates of Pap testing are reported among AI women,^{3–5} examining relevant correlates of their Pap testing behaviors is imperative. In addition, since health literacy can be modified through culturally appropriate interventions,⁸ it is important to examine and understand how health literacy is shaped among AI women. Therefore, the purpose of this study is to examine how sources and types of health information impact health literacy, and in turn, how health literacy and other factors influence the Pap testing behaviors of AI women.

THEORETICAL FRAMEWORK

An adapted Health Literacy Skills (HLS) conceptual framework guided the selection of study variables.³⁴ The original premise of the HLS framework is to address the multidimensionality of health literacy and illustrate “the full continuum of relations among predictors, mediators and outcomes of health literacy.”³⁴ In African communities, female friends/family also serve as portals for the dissemination of women’s health information,^{16,17,19,35} and they play a crucial role in African women’s adaptation of health behaviors such as cancer screening.¹⁸ Based on these findings, we adapted the HLS framework to include antecedents of health literacy (i.e., sources and types of health information), health literacy, and mediators (i.e. self-efficacy, decisional balance, cultural beliefs/attitudes and cancer knowledge) of the relationship between health literacy and health behavior.³⁴ Sources of health information was defined as the interpersonal relationships made through social ties or with

healthcare providers that influence health behaviors and health beliefs,^{36,37} and included family/relatives, friends, ethnic church, TV/Radio, Internet, social media and physician/healthcare provider. Types of health information was defined as the communication strategies for disseminating health information with the aim of influencing health beliefs and behaviors,³⁶ and included verbal, written text and pictures. For the purpose of this study, health literacy was conceptualized as a multi-dimensional concept to include individuals' "ability to use medical terminology (familiarity) and apply relevant medical terms throughout the cancer screening trajectory (navigation)."^{12,38} Finally, the following psychosocial and cultural variables were assessed as correlates of health behavior: Cancer knowledge, conceptually defined as what a person knows about cervical cancer;³⁹ self-efficacy, defined as how confident a person is in carrying out tasks such as receiving a Pap test;⁴⁰ decisional balance, conceptually defined as the perceived pros and cons of a health behavior,⁸ and cultural beliefs/attitudes, defined as the principles, values and customs that inform a person's health behavior such as receiving a Pap test.⁴¹

METHODS

Study Design and Sampling

The African immigrant women Pap testing behavior (AfroPap) study used a cross-sectional design. A convenience sample of 167 women were recruited using two main sampling methods: in-person and online surveys via Qualtrics, an encrypted, data management and web-based survey tool. Participants were eligible to enroll in this study if there were females, 21-65 years old, self-identified as AI, had no history of hysterectomy, could read and write English, and resided in the U.S.

Procedures

All study procedures were approved by an academic institutional review board (IRB). Potential participants were approached at various African churches and community organizations where the study was announced, and flyers were disseminated. Trained bilingual research assistants obtained oral informed consent from in-person participants. The online survey included a copy of the IRB-approved oral consent script and an eligibility self-screener. Participants who completed the in-person surveys received a weblink to the online survey and were encouraged to share it with other AI women within their social networks. The weblink to the online survey was also disseminated using WhatsApp, a social media and communication platform commonly used within the African immigrant community. The online survey was limited to individuals who could complete the survey on their own with no assistance from the research team. Data collection occurred between November 2017 and December 2018. Study participants received a \$5 gift card after survey completion. Individuals who completed the survey online received the gift card via mail.

Measures

Individual characteristics and screening-related variables: Individual characteristics and screening-related variables were collected using a questionnaire developed for the purpose of this study. The information collected included age (21-65 years), health insurance coverage (yes/no), educational attainment (less than high school, high school, college, more than college), marital status (married, never married, separated/divorced), employment (employed full- or part-time/unemployed), primary health care access (yes/no). employment (employed full- or part-time/unemployed), primary health care access (yes/no). Income was assessed with the question, “Can you give an estimate of your annual household income?” and participants were categorized as low or high based on the sample median. English proficiency was measured with the questions, “(1) How well do you speak in English? (2) Can you converse in English? (3) Can you

Speak over the phone in English? (4) Can you read English newspapers? (5) How well can you interact at the hospital without the assistance of translators? and (6) Do you need help reading instructions or pamphlets you receive from the doctor or pharmacist?" The first five items were scored on a 4-point (1-4) Likert scale and a 5-point (1-5) Likert scale for the last item. Higher scores indicated higher English proficiency. Physician recommendation was measured with the question, "Has a healthcare provider recommended that you get a Pap test during the past 3 years?" (yes/no). Finally, history of Pap testing was measured with the question, "Have you ever had a Pap test?" (yes/no), "When was your last Pap test (month/year/place).

Antecedents of health literacy: Types of health information was measured with the question, "How is women's health information often presented to you?" (verbal/written text/pictures/other), with participants given the option to mark all that apply. Sources of health information was measured with the question, "From whom do you most likely get advice about women's health? (female family/relatives, female friends, pastor/church, TV/radio, internet, social media, physician/healthcare practitioner, and other), with participants given the option to mark all that apply.

Health literacy: The Assessment of Health Literacy-Cancer (AHL-C) is a validated instrument to assess health literacy in the context of women's cancer screening with evidence of reliability and validity.¹² Based on Baker's¹³ conceptualization of health literacy, the AHL-C addresses multiple dimensions of health literacy: print literacy, comprehension, familiarity, numeracy and navigation. A recent study revealed that the familiarity and navigational literacy sub-scales of the AHL-C were strongly associated with an increased likelihood of Pap testing.³⁸ Hence these two sub-scales were used to assess health literacy in our study. Familiarity scale includes 12 items which assess individuals' ability to use relevant medical terminologies.

Navigational literacy scale includes 12 clause items that assess individuals' ability to apply relevant medical terms throughout the cancer screening trajectory) with questions such as, "Please sit down and roll up your sleeve. I will measure your ____;" "Please tell me whether you have abnormal symptoms such as ____ in your breast."¹² Higher scores on the AHL-C scales indicated higher health literacy levels. The internal consistency (Cronbach's alpha) for the navigation and familiarity sub-scales were 0.92 and 0.96, respectively, in the original validation sample, and 0.86 and 0.98 in the current study sample.

Cultural beliefs/attitudes: The Tang, Solomon and McCracken instrument⁴¹ consist of a 5-point Likert scale with 3 items measuring the use of home remedies with questions such as, "I use home remedies as treatment for health problems" and a 5-point Likert scale with 6 items measuring perceived cultural barriers to Pap testing with questions such as, (1) "I would feel embarrassed with a doctor examining my cervix as part of a medical exam," and (2) "I would feel uncomfortable talking about my body with a doctor." Higher scores indicated negative culture beliefs and attitudes. In the original validation sample, the Cronbach's alpha coefficients for the use of home remedies and perceived cultural barriers sections were 0.72 and 0.68 respectively. In our study sample, the internal consistency (Cronbach's alpha) for the combined sections was 0.78.

Cervical cancer knowledge: The modified Cervical Cancer Knowledge Test consists of a binary (true/false) scale with 21-items. The first 10 items (Cronbach's alpha: 0.80-0.89)⁴² assess knowledge of cervical cancer risk factors and symptoms with questions such as, "If a woman gets cervical cancer, it can be detected early." The remaining 11 items (Cronbach's alpha: not reported)⁴³ assess knowledge on HPV infection and prevention such as, "HPV can be prevented

by vaccination.” Higher scores indicated higher cervical cancer knowledge. The modified 21-item scale yielded an internal consistency (Cronbach’s alpha) of 0.87 in our study sample.

Self-efficacy: The 4-item self-efficacy scale⁴⁴ measures how confident a woman is in carrying out tasks in relation to Pap testing using a 4-point (1=not at all confident to 4=very confident) Likert scale. The scale includes questions such as, “Do you feel confident that you can have a Pap test on a regular schedule?” Higher scores indicate higher self-efficacy. In our study sample, the self-efficacy scale yielded an internal consistency (Cronbach’s alpha) of 0.93.

Decisional balance: Decisional balance refers to women's perception about pros and cons of cervical cancer screening. The decisional balance scale has 12 items and uses a 5-point Likert scale (1=strongly disagree to 5=strongly agree). The scale includes questions such as (1) “A Pap test can be done so quickly that it is not a bother to have one;” (2) “A Pap test is not as important as people say it is.” Negatively worded items were recoded, and total scores were calculated. Higher scores indicate higher decisional balance. The decisional balance scale had an internal consistency (Cronbach’s alpha) of 0.76-0.86 in the original validation sample.⁴⁵ The Cronbach’s alpha for our study sample was 0.81.

Sample Size

Previous community-based, cancer prevention studies in the U.S included AI sample sizes ranging from 63 to 100, and estimated the prevalence of Pap testing among AI women to be between 19% to 70%.^{18,46} Using a sample size of 157 and alpha of 0.05, our study would have 90% power to detect an OR of 3.43 or higher to be statistically significant.

Data Analysis

Descriptive statistics such as frequencies and percentages were calculated for all categorical variables. For continuous variables, means and standard deviations were reported.

Two participants had missing data for the entire decisional balance scale and their values were replaced with the sample mean for the scale. To examine the association between selected study variables and past Pap testing, we used a series of logistic regression models. First, in order to examine the relationship between antecedents (i.e., types and sources of health information) and health literacy, dummy variables were created for participants who used 0-1 and 2+ sources and types of health information. For health literacy, participants were categorized as high and low by using 75th percentile scores. Second, bivariate logistic regression was used to test the relationship between theoretically selected study variables and Pap testing. Multivariable logistic regression was then used to evaluate factors associated with Pap testing after adjusting for covariates. For psychosocial factors (i.e., cancer knowledge, decisional balance, and self-efficacy), participants were categorized as high and low by using 75th percentile scores for cancer knowledge and mean for other variables. Based on a literature review of Pap test screening among immigrant women, the following variables were controlled for as covariates: age, education, English proficiency, employment, income, insurance, access to primary care, marital status, and healthcare provider recommendation. Multicollinearity was assessed and the variance inflation factor (VIF) was reasonable (VIF<5). Finally, we tested a possible mediation of theoretically selected psychosocial variables in the relationship between health literacy and Pap testing using the Baron and Kenny⁴⁷ four step approach. Tests of mediation using regression analyses would not be warranted if no significant association is found between health literacy and Pap testing. The statistical significance was considered when $p < 0.05$.

RESULTS

Sample Characteristics

The description of sample characteristics is reported in Table 1. A total of 167 AI women participated in the AfroPap study, with a majority of participants (n=91) recruited in-person and the remaining (n=76) recruited online. Participants' ages ranged from 22-65 years and the mean (SD) age was 40.90 (12.25) years. Most participants were college educated (68%), married (57%), employed (80%), and reported having health insurance coverage (79%) and a primary care physician (74%). The average length of stay in the U.S. was 15 (7.76) years, and more than half (54%) of the participants had lived in the U.S. for 15 years or more. The average (SD) English proficiency score was 22.69 (3.86), indicative of high overall English proficiency among study participants. Participants recruited online were significantly younger (mean age: 33.96 years) and had higher average English proficiency scores (23.71) than those recruited in person (mean age: 46.70 years, English proficiency score: 21.84). No significant differences were found between the online and in-person groups in relation to employment status, income, health insurance coverage, length of stay and history of Pap testing.

Overall, AI women's knowledge on cervical cancer risk factors and symptoms were low; more than two thirds of the participants (86%) scored lower than the 75th percentile on the Cervical Cancer Knowledge Test. Most participants (57%) reported high self-efficacy, and in relation to their perceived pros and cons of Pap testing, 62% of participants had a high decisional balance. Most participants (53%) reported negative cultural beliefs and attitudes towards Pap testing. More than half of the study participants reported using multiple sources of health information (65%), and often having health information presented in multiple forms (57%). Seventy-one percent of the participants (n=118) reported that they had received a Pap test in the past. Among AI women who reported no history of Pap testing (n=49), 75% reported that no healthcare provider had recommended that they receive a Pap test in the past 3 years. On the

AHL-C scale, 53% (n=88) of AI women had high health literacy levels and 47% (n=79) had low health literacy levels.

Multiple logistic regression analyses

Antecedents of health literacy

As shown in Table 2, there were no significant associations between using multiple sources and types of health information and health literacy after controlling for all covariates. As indicated in Table 3, there was an association between AI women who used multiple sources of health information and Pap testing, and this relationship remained significant (aOR: 0.11, $p<0.01$) even after controlling for covariates. No significant association was found between multiple types of health information and Pap testing, however.

Health literacy, cultural and psychosocial correlates of Pap testing

As indicated in Table 3, in the bivariate model, high self-efficacy (OR: 12.47, $p<0.001$), high decisional balance (OR: 5.28, $p<0.001$) and negative cultural beliefs/attitudes (OR: 0.13, $p<0.001$) were associated with Pap testing. After adjusting for all covariates, only the relationship between high self-efficacy (aOR: 9.38, $p<0.01$), negative cultural beliefs/attitudes (aOR: 0.17, $p=0.01$) and Pap testing remained significant. High health literacy (OR: 3.23, $p<0.01$) was associated with Pap testing in the bivariate model, but the relationship was no longer significant after adjusting for main study variables (cervical cancer knowledge, self-efficacy, decisional balance, cultural beliefs/attitude) and other covariates. Since after controlling for covariates, we found no significant association between health literacy and Pap testing, the first step of the Baron and Kenny⁴⁷ test of mediation was not met. Therefore, no further tests of mediation were warranted.

DISCUSSION

The purpose of this study was to examine theoretically selected variables (i.e., antecedents of health literacy such as types and sources of health information, health literacy, and other psychosocial and cultural factors) in relation to Pap testing among AI women living in the United States. A large proportion of our study participants (71%) reported receipt of a Pap test. This result is contrary to findings from previous studies which reported lower rates of Pap testing among AI women whose screening rates ranged from 20% to 70% , in comparison to 35%-85% in other immigrant samples (Asian, Hispanic, Eastern European).^{46,48-50} Compared to previous studies, our study participants also reported higher rates of health insurance coverage (74%) and access to primary care (79%), two factors known to be associated with higher rates of Pap testing among immigrants.^{16,51} This may have resulted in the higher prevalence of Pap testing reported in our study sample. Secondly, previous studies have shown that self-reported Pap testing rates are overestimated and often vary from Pap test rates that are based on medical records.⁵² The prevalence of Pap tests reported in the AfroPap study were based on women's self-reports and could be an overestimation of women's actual Pap testing history.

Using television, print media and the internet to convey health information with the goal of encouraging behavior modification such as healthy diets and exercise has been studied. What is lacking, however, are quantitative studies to examine the strength of association between sources and types of health information and cancer screening behaviors.^{15,53} One study which included predominantly non-Hispanic white women showed an association between the use of television as a source for health information and an increased odds of mammography.¹⁵ Previous studies suggest that AI women health behaviors are potentially influenced by the health information they receive and share within their social circles.^{18,54} Based on these findings, we

also performed an exploratory analysis to examine the impact of sources (female relatives, female friends, pastor/church, TV/Radio, Internet, social media, physician/healthcare provider) and types (verbal, written text, pictures) of health information on AI women's Pap testing behaviors. Our findings indicate that using multiple (2 or more) sources of health information is associated with an 89% lower odds of Pap testing. We also found a positive correlation between women's educational attainment and use of the internet and healthcare providers as sources of health information. An inverse relationship was found among educational attainment and the use of family, friends and ethnic churches as health information sources (data not shown). This finding is similar to previous studies on Haitian immigrants⁵⁵ and Iraqi adults¹⁴ which showed that highly educated individuals are likely to report using single sources (i.e. the internet or healthcare providers) of health related information compared to lower educated individuals who use multiple sources (i.e. friends, family, religious organizations) of health information to inform their health behaviors. We found no association between types of health information and Pap testing among AI women. The lack of variability in the types of health information study participants received regardless of their history of Pap testing could explain our non-significant findings. Our results highlight the need for further studies to explore AI women's preferred sources/types of health information, and how their perceived usefulness influence AI women's health behaviors.

AI women with higher cultural beliefs/attitudes scores, indicative of fatalistic beliefs about cervical cancer and negative attitudes towards Pap testing, were 83% less likely to report the receipt of a Pap test in the past. This finding shows that among AI women, culture plays a critical role in informing and shaping cancer screening behaviors regardless of other known social determinants of health such as education, healthcare access and English proficiency. This

result is new from previous studies which showed that cultural beliefs and attitudes played a less critical role in the cancer screening behaviors of immigrant women with high English proficiency and educational levels.^{9,56} Our finding also shows that when addressing the cancer health needs of AI women, the development and use of culturally tailored programs to address the cancer health needs of AI women could be an effective strategy .

Previous studies have reported that immigrants who have stayed longer in a host country are more likely to be well acquainted with the host country's healthcare system and are likely to utilize the preventive care services which are provided.^{57,58} In the AfroPap study, we found no significant association between years of stay in the U.S and AI women's receipt of a Pap test. Among immigrant groups, acculturation is shown to be a stronger predictor of health behaviors than individuals' length of stay in a host country. Previous studies that used length of stay as a proxy measure for acculturation reported mixed findings.^{16,59,60} This could explain the nonsignificant findings in our study. Future studies that use psychometrically tested instruments to assess the influence of acculturation on Pap testing behaviors among AI women are needed. Higher odds of Pap testing were seen among AI women who reported having a healthcare provider compared to women who reported no primary care access. In addition, AI women with higher English proficiency scores reported significantly higher odds of Pap testing compared to those with lower English proficiency scores. This finding is consistent with several studies which reported access to a primary healthcare as known facilitator of Pap testing, and low English proficiency as a barrier to women's receipt of a Pap test.^{51,56,57} The majority of our participants have health insurance coverage (79%) so they are likely to have access to primary care. Also, participants migrated mainly from African countries where English is spoken as an

official language, so participants are likely to be more English proficient than other groups migrating from countries where English is not the official language.

Low health literacy is a strong predictor of the utilization of preventative health services among immigrants, with previous studies indicating the important role that improving the health literacy of immigrants could help in addressing health disparities, particularly in relation to cancer outcomes.^{8,9,57} Our findings indicated that AI women with high health literacy levels were 3 times more likely to report receipt of a Pap test compared to those with lower health literacy levels at bivariate level. Individuals' health literacy levels are directly impacted by their educational attainment.⁶ Our findings show that 47% of AI women have low health literacy levels. This proportion is drastically lower than what was reported (71%) in a Norwegian study on low educated (70% less than high school education) Somali immigrants.⁵⁷ A high proportion of our study participants are English proficient (77%) and college educated (68%), and this may have potentially influenced the higher health literacy levels reported.

Recruiting and enrolling immigrants and ethnic/minority groups in research studies can be particularly challenging.^{61–63} In the U.S., the recruitment of AIs for cancer prevention studies are not well documented, and previous studies have mostly included African immigrant participants residing in a specific region (e.g. Minnesota, Washington D.C) or originating from a specific country (e.g. Ghana, Nigeria and Somalia).⁶⁴ In order to reach and recruit a diverse sample of AI women for the AfroPap study, we recruited participants using both online and in-person strategies. Within a one-year period, we met our study goal of recruiting a total of 167 AI women, and online recruitment resulted in the highest yield (data reported in another study).⁶⁴ Similar to previous studies, participants recruited online were younger than those recruited in

person.^{65,66} The two groups, however, did not differ in employment status, income, health insurance coverage, length of stay and history of Pap testing.

Strengths and limitations

Study participants' history of Pap testing was self-reported, which limits the generalizability of study findings due to potential recall bias. We used a cross-sectional design which precludes causality. Our convenience sample of 167 also delimits the study's generalizability because participants recruited online were significantly younger and had higher English proficiency scores compared to AI women recruited in-person who were older and reported lower English proficiency scores. However, it is worth noting that the demographic characteristics of our study participants are similar to national data on African immigrants currently living in the U.S.²⁹ We found no significant association between health literacy and Pap testing after controlling for covariates so no further tests of mediation were warranted. Larger longitudinal studies are needed to test for potential psychosocial and cultural mediators of the relationship between health literacy and Pap testing among AI women. We observed wide confidence intervals on the variables, "self-efficacy" and "primary care." A large proportion of participants reported access to a primary care provider (74%) and high self-efficacy (57%). It is possible that both variables were underpowered when we conducted multiple adjusted analyses. This study had several strengths which outweigh the limitations we identified. First, this is one of the first studies to quantitatively analyze the health literacy levels of AI women in the U.S. We successfully recruited a potentially "hard-to-reach" immigrant population using both in-person and online recruitment strategies. In order to increase study participants' willingness to answer gender-specific and sensitive reproductive health questions, the research staff, including the principal investigator were female, African immigrants. The research team members spoke

various African dialects (*Twi, Ga, Pidgin, Igbo*), thus enabling effective communication with potential study participants who required some assistance in completing the study surveys.

IMPLICATIONS

Physician recommendations, access to primary health care, sources of health information and negative, fatalistic cultural beliefs/attitudes may explain why AI women decide to utilize cancer screening services. To further understand how these factors, impact AI women's cancer screening behaviors calls for larger studies which utilize a robust sampling strategy and include a diverse group of African immigrants. To gain an in-depth understanding of how cultural beliefs impact health behaviors among AI women calls for methodologically rigorous studies that utilize both quantitative and qualitative research designs. In terms of recruitment strategies, using the internet appears to be a promising strategy to consider for future studies that include African immigrants.

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Table 1: Sample Characteristics

Characteristics	Overall (N=167)	In-person surveys (n=91)	Online surveys (n=76)	p-value
Age, y Mean (SD)	40.9 (12.25)	46.7 (11.27)	34.0 (9.48)	<0.001
Range, y	22-65	22-65	22-61	
Education				
<HS	19 (11)	17 (19)	2 (3)	0.001
High school	34 (20)	31 (23)	13 (17)	
College	114 (68)	53 (58)	61 (80)	
English proficiency score Mean (SD)	22.7 (3.86)	21.8 (4.56)	23.71 (2.46)	0.001
Employment (n, %)				
Employed	134 (80)	71 (78)	63 (83)	0.215
Unemployed	23 (14)	16 (18)	7 (9)	
Other	10 (6)	4 (4)	6 (8)	
Income (n, %)				
Low	84 (50)	45 (49)	38 (50)	0.944
High	83 (50)	46 (51)	38 (50)	
Health insurance (n, %)				
Yes	132 (79)	68 (75)	64 (84)	0.134
No	35 (21)	23 (25)	12 (16)	
Primary care				
Yes	123 (74)	68 (75)	55 (72)	0.731
No	44 (26)	23 (25)	21 (28)	
Marital status (n, %)				
Married	95 (57)	62 (68)	33 (43)	<0.001
Never married	45 (27)	10 (11)	35 (46)	
Separated/Divorced	27 (16)	19 (21)	8 (11)	
Physician recommendation (n, %)				
Yes	97 (58)	54 (59)	43 (57)	0.719
No	70 (42)	37 (41)	33 (43)	
Length of stay Mean (SD)	15.12 (7.76)	15.91 (8.29)	14.14 (6.99)	0.14
Sources of health information (n, %)				
0-1	59 (35)	31 (34)	28 (34)	0.709
2 or more	108 (65)	60 (66)	48 (66)	
Types of health information (n, %)				
0-1	72 (43)	45 (49)	27 (36)	0.070
2 or more	95 (57)	46 (51)	49 (64)	
Cervical cancer knowledge (n, %)				
High	24 (14)	8 (9)	16 (21)	0.024
Low	143 (86)	83 (91)	60 (79)	
Self-efficacy (n, %)				
Low	71 (43)	26 (29)	45 (59)	<0.001
High	96 (57)	65 (71)	31 (41)	
Decisional balance (n, %)				
Low	63 (38)	36 (40)	27 (36)	0.592

High	104 (62)	55 (60)	49 (64)	
Cultural beliefs/attitudes	79 (47)	45 (49)	34 (45)	
Low (positive)	88 (532)	46 (51)	42 (55)	0.543
High (negative)				
Health Literacy (n, %)				
Low	79 (47)	51 (56)	28 (37)	0.013
High	88 (53)	40 (44)	48 (63)	
History of Pap testing (n, %)				
Yes	118 (71)	70 (77)	48 (63)	0.052
No	49 (29)	21 (23)	28 (37)	

Table 2: Logistic regression model showing the association between sources and types of health information and health literacy

Characteristics	Unadjusted OR (95% CI)	p-value	*Adjusted OR (95% CI)	p-value
Sources of health information				
0-1	Ref	Ref	Ref	Ref
2 or more	1.38 (0.73-2.62)	0.317	0.97 (0.37-2.58)	0.958
Types of health information				
0-1	Ref	Ref	Ref	Ref
2 or more	1.98 (1.07-3.69)	0.031	2.56 (0.97-6.72)	0.056

*Adjusted for age, education, English proficiency, employment, income, insurance, access to medical care, marital status, physician recommendation, length of stay

Table 3: Logistic regression showing factors associated with Pap testing

Characteristics	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age, y Mean (SD)	1.03 (1.00-1.06)	0.028	1.11 (1.01-1.22)	0.031
Education				
<HS	Ref	Ref	Ref	
High school	1.58 (0.51-4.91)	0.423	0.23 (0.01-3.66)	0.299
College	1.47 (0.36-6.00)	0.007	0.43 (0.03-6.69)	0.546
English proficiency score	1.22 (1.11-1.34)	0.000	1.50 (1.05-2.13)	0.023
Employment				
Unemployed	Ref	Ref	Ref	Ref
Employed	2.81 (1.13-6.95)	0.026	1.34 (0.16-11.22)	0.789
Other	0.92 (0.20-4.05)	0.909	0.19 (0.03-1.34)	0.095
Income				
Low	Ref	Ref	Ref	0.501
High	2.81 (1.39-5.65)	0.004	0.60 (0.13-2.70)	
Health insurance				
No	Ref	Ref	Ref	0.739
Yes	4.04 (1.85-8.81)	0.000	0.74 (0.12-4.44)	
Primary care				
No	Ref	Ref	Ref	Ref
Yes	7.29 (3.40-15.62)	0.000	9.14 (1.90-44.07)	0.006
Marital status				
Married	Ref	Ref	Ref	Ref
Never married	0.24 (0.11-0.52)	0.000	0.66 (0.12-3.47)	0.619
Separated/Divorced	0.71 (0.26-1.94)	0.508	1.81 (0.13-26.08)	0.662
Physician recommendation				
No	Ref	0.000	Ref	0.006
Yes	7.94 (3.69-17.07)		8.31 (1.83-37.67)	
Length of stay	1.08 (1.03-1.13)	0.003	1.08 (0.97-1.20)	0.172
Sources of health information				
0-1	Ref	Ref	Ref	Ref
2 or more	0.31 (0.14-0.69)	0.004	0.11 (0.02-0.53)	0.006
Types of health information				
0-1	Ref	Ref	Ref	Ref
2 or more	0.99 (0.50-1.93)	0.966	1.57 (0.32-7.66)	0.575
Cervical cancer knowledge				
Low	Ref	0.327	Ref	0.528
High	1.69 (0.59-4.81)		0.54 (0.08-3.67)	
Self-efficacy				
Low	Ref	Ref	Ref	Ref
High	12.47 (5.43-28.64)	0.000	9.38 (2.10-41.93)	0.003

Decisional balance				
Low	Ref	Ref	Ref	Ref
High	5.28 (2.58-10.82)	0.000	1.70 (0.33-8.67)	0.525
Cultural beliefs/attitudes				
Low (positive)	Ref		Ref	
High (negative)	0.13 (0.06-0.30)	0.000	0.17 (0.04-0.71)	0.015
Health literacy				
Low	Ref		Ref	
High	3.23 (1.60-6.51)	0.001	0.55 (0.10-3.17)	0.504

Full model presented | OR: Odds Ratio CI: Confidence interval

CHAPTER 6

Title: Verbal communication plays an integral role in shaping the health literacy of African immigrant women

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Abstract

Background: Health literacy is a strong determinant of health outcomes among immigrants. How sources and types of health information influence the health literacy of African immigrants (AI) remains unknown.

Objective: To explore how various sources and types of health information influence health literacy in cancer screening among AI women.

Method: Using a mixed-methods approach, a convenience sample of AI women (N=167) completed study surveys followed by semi-structured individual phone interviews with a purposive sub-sample (n=20) of survey participants. The relationship between sources and types of health information and health literacy was assessed using multivariate logistic regression. Emergent themes were identified in the qualitative interviews using content analysis. Qualitative and quantitative data were merged to describe differences and similarities in AI women's experiences and display of health literacy by different sources and types of health information.

Results: Healthcare providers (78%), female friends (46%) and internet (45%) were the most common sources of health information used by AI women followed by female relatives (32%), television (22%), social media (17%) and church (16%). Content analysis revealed: Healthcare provider was rated the most credible source; family/friends personal experiences made health information more relatable; church as the least endorsed source. Health information presented verbally (aOR: 5.51, p=0.01) was associated with higher health literacy even after controlling for covariates. Most AI women had health information presented in verbal form (80%), with pictures (43%) being the least popular type of health information.

Conclusion: Study findings suggest that verbal communication may play an integral role in shaping the health literacy of AI women. Health interventions that utilize peer educators (female friends/family) and incorporate verbal communication could be more effective strategy in promoting positive health behaviors among AI women. In the clinical setting, healthcare providers should consider presenting health information to AI women in verbal rather than written forms.

Key terms: health literacy, sources of health information, types of health information, verbal communication, African immigrants

INTRODUCTION

In the U.S., health disparities persist among ethnic/racial minority and immigrant groups, and the African immigrant (AI) population is identified as one of the most vulnerable immigrant groups[1]–[4]. As of 2015, there are over 2 million AIs residing in the United States (U.S), and this number is expected to increase about ten-fold in the next decade [5]. The majority (56%) of AIs migrated to the U.S from Nigeria, Ethiopia, Ghana, Kenya and South Africa, where English is spoken as an official language [5], [6]. Compared to other fast growing immigrant groups (i.e. Hispanic, Korean, Chinese, Filipino) in the U.S., AIs tend to be younger, more English proficient, and have higher educational and economic (income and employment) attainments[6]. Yet, studies show that AIs report inadequate utilization of health services and poor health outcomes than other immigrant groups. For example, AIs have lower Pap testing rates (26%-48%)[7], [8] compared to the higher rates (52%-70%) reported among Asian immigrants (Korean, Vietnamese, Cambodian) [8], [9]. AIs also report higher cardiovascular disease prevalence (28%) than is reported among Hispanic (12%-20%) and Asian (9%-21) immigrants [10]–[12]. Addressing the health disparities faced by AIs, a steadily increasing, yet vulnerable immigrant, ethnic/racial population in the U.S. is a significant public health and research priority [13].

Low health literacy is a primary contributor to health disparities [3], [4], [14]. Health literacy is defined as individuals' ability to "obtain, process, understand and use basic health information and services to make appropriate health decisions" [4]. Among immigrant populations in the U.S, low health literacy has been associated with the underutilization of appropriate health services and poor health outcomes. For instance, Hispanic and Chinese immigrants with lower health literacy reported lower rates of cancer screening [15]–[17], lower physical activity[18], higher rates of depression [14] and poorer quality of life[19] compared to

those with higher health literacy levels. High health literacy levels is shown to improve individuals' ability to evaluate the quality of health information [20], [21], apply health-related instructions to inform health behaviors [22], [23], and communicate effectively with healthcare providers [24], [25]. It is evident that having higher literacy levels empowers people to maintain good health [4], [26]. Therefore, improving health literacy levels of AIs could be a critical step in addressing the health disparities evident in this population.

Sociodemographic factors and certain characteristics of health information have been examined in relation to health literacy[4], [26]. Previous studies on immigrant and ethnic/racial minority groups have focused primarily on the sociodemographic (i.e. age, income, education, English proficiency and access to medical care) determinants of health literacy [4]. For example, lower health literacy levels are reported among: Older Korean immigrants[27] ; Hispanic and Chinese immigrants with low English proficiency[17], [27]; and African Americans with low income and limited access to primary care[28], [29]. The literature is scarce, and it is not completely clear how characteristics of health information influence health literacy. Yet, available research seems to suggest that certain characteristics (e.g., sources and types) of health information may also influence where African individuals seek health information, the significance they assign to the health information received, and how they respond to recommendations for health behavior modifications[4], [30]. For example, female friends and family [31], [32] served as a main source of health communication and information for African women in relevance to their HIV knowledge and screening behaviors. As for types of health communication, verbal exchange has been a prominent form among African women, which is consistent with the traditional African culture, where health knowledge, beliefs, and practices are

passed down through generations, and shared among social networks through speeches, songs, and folktales [33], [34].

These prior studies suggest a culturally relevant pathway through which we could better understand the interplay between sources and types of health information and health literacy among AIs, a population that is burdened by poor health outcomes. Therefore, the purpose of this mixed-methods study was to explore how various sources and types of health information influence information sharing and health literacy among AI women. For the purpose of this study, sources of health information was defined as the interpersonal relationships made through social ties that influence health behaviors and health beliefs, and included family/relatives, friends, ethnic church, TV/Radio, Internet, social media and physician/healthcare provider [35], [36]. Types of health information was defined as the communication strategies for disseminating health information with the aim of influencing health beliefs and behaviors, and included verbal, written text, and pictures [35]. Finally, health literacy was conceptualized as a multi-dimensional concept to include individuals' familiarity with and understanding of basic medical terms, and how that enhances their ability to navigate the healthcare system for preventive health services such as cancer screening [37], [38].

METHODS

Study Design

The data used for this analysis came from an explanatory mixed methods study designed to examine how health literacy, cultural and psychosocial (cancer knowledge, self-efficacy, decisional balance) factors influence the Pap testing behaviors of AI women[39]. The quantitative strand of the study provided a general understanding of the statistical relationships among sources and types of health information and health literacy. The qualitative strand then

provided an in-depth understanding of the quantitative data by explaining the various sources and types of health information AI women use to inform their health behaviors. Finally, the quantitative and qualitative data were integrated to explain how health literacy differ by AI women's sources and types of health information to help us better understand the interplay between the characteristics of health information and health literacy [40].

Sampling

A convenience sample of 167 women were recruited using two main recruitment approaches: online and in-person surveys via Qualtrics, a web-based survey tool. Detailed recruitment methods are described elsewhere[41]. Briefly, potential study participants were approached at various African immigrant churches and community organizations. The online survey included a copy of the IRB-approved oral consent script and an eligibility self-screener. The online survey was limited to individuals who could complete the survey on their own with no assistance from the research team. Participants were eligible to enroll in this study if there were females, 21-65 years old, self-identified as African immigrants, had no history of hysterectomy, could read and write English and resided in the U.S. Using both in-person and online recruitment strategies helped to maximize the recruitment catchment and diversity (i.e. African nationality) of study participants. For the qualitative phase of the study, we purposively sampled AI women from the larger quantitative study based on health literacy levels (high/low), history of Pap testing (yes/no) and demographic characteristics (age, educational attainment, and English proficiency). Participants (n=20) were interviewed until data saturation was indicated by no new emergent themes.

Procedures

All study procedures were approved by an academic institutional review board (IRB). Data collection occurred between November 2017-December 2018. For participants who completed the in-person survey, oral informed consents were obtained by trained bilingual research assistants at study sites. The in-person survey completers received a weblink to the online survey and were encouraged to share it with other AI women within their social networks. The weblink was also disseminated using WhatsApp, a social media and communication platform commonly used within the African immigrant community. The online survey included a copy of the IRB-approved oral consent script and an eligibility self-screener. All study participants received a \$5 gift card after survey completion. Gift cards were mailed to those who completed the survey online. Because study participants were recruited from all over the U.S., we conducted one-on-one interviews exclusively on the phone; interviews lasted approximately 30 minutes on average. Each individual phone interview was recorded and transcribed verbatim. Individual interview participants received additional \$5.

Quantitative Measures

Sociodemographic characteristics: A questionnaire designed for the purpose for this study was used to collect quantitative data on individual characteristics known to influence health literacy levels. The information collected included age (21-65y years), education (less than college, college educated), access to primary care (yes/no). Income was assessed with the question, “Can you give an estimate of the annual household income?” and participants were categorized as low or high based on sample median. English proficiency was measured with the questions, “(1) How well do you speak in English? (2) Can you converse in English? (3) Can you speak over the phone in English? (4) Can you read English newspapers? (5) How well can you interact at the hospital without the assistance of translators? and (6) Do you need help

reading instructions or pamphlets you receive from the doctor or pharmacist?” The first five items were scored on a 4-point (1-4) Likert scale and a 5-point (1-5) Likert scale for the last item. Higher scores indicated higher English proficiency.

Sources and Types of health information: Types of health information was measured with the question, “How is women’s health information often presented to you?” (verbal/written text/ pictures/other), with participants given the option to mark all that apply. Sources of health information was measured with the question, “From whom do you most likely get advice about women’s health? (female family/relatives, female friends, pastor/church, TV/radio, internet, social media, physician/healthcare practitioner, and other), with participants given the option to mark all that apply.

Health literacy: The Assessment of Health Literacy-Cancer (AHL-C) [37] was used to measure participants’ health literacy (i.e., familiarity and navigational ability) in the context of cancer screening. The AHL-C has evidence of reliability and validity [37]. Higher total scores indicated higher health literacy levels. The internal consistency (Cronbach’s alpha) for the navigation and familiarity sub-scales in the original validation sample were 0.92 and 0.96, respectively, and 0.86 and 0.98 in our study sample.

Qualitative measure

Interview guide: For the qualitative phase of the study, in-depth data were collected using a semi-structured interview guide. Example questions included, “If you had any questions about your health, who would you talk to, and why” and “Describe a health information you found useful.” Full interview guide is included in Appendix 1.

ANALYSIS

All quantitative analyses were performed using STATA 14. Descriptive statistics such as frequencies and percentages were calculated for all categorical variables and means with standard deviations were reported for continuous variables. To examine the relationship between sources and types of health information and health literacy, we created dummy variables (yes/no) for participants who used or did not use the various sources and types of health information. For health literacy, participants were categorized as high and low using 75th percentile scores. We used multivariable logistic regression to test the relationship between sources and types of health information and health literacy. We controlled for age, education, income, English proficiency, and healthcare access as covariates [4] and considered statistical significance if $p < 0.05$. The qualitative data was analyzed using inductive coding and qualitative content analysis [42], [43]. After reading each transcript multiple times, four coders conducted initial coding independently. The coders then categorized the initial codes and grouped them into emerging themes. The study team discussed all emergent themes and finalized on themes and sub-themes after all discrepancies were addressed. Throughout the coding process, reflexivity was maintained through written memos. The study team enhanced the transferability of findings, by providing a thorough description of study findings using verbatim transcripts and relevant quotes. Trustworthiness was also achieved through research team discussions, along with audit trail documentation [44], [45]. In the final phase, we integrated results from the quantitative and qualitative analyses by jointly displaying main sources and types of health information using the themes emerged from the qualitative analysis with the results from quantitative, bivariate and multivariate logistic analyses.

RESULTS

Sample characteristics

A total of 167 African immigrant women participated in the survey. Sample characteristics for the quantitative phase of the study are reported in Table 1. Participants ages ranged from 22-65 years, and the average age (SD) of study participants was 40.90 (12.25). Most participants (68%) were college educated and had access to primary care (74%). The average (SD) English proficiency score was 22.69 (3.86), indicating a high overall English proficiency. Eighty-eight participants (53%) had high health literacy levels and 47% (n=79) had low health literacy levels. Table 2 summarizes the characteristics of a subset of 20 participants who were interviewed for the qualitative phase of the study. Out of 20 AI women interviewed, 15 had high health literacy levels and 5 had low health literacy levels. In general, the characteristics of the subsample were similar to those of the survey sample.

Sources of health information

Table 3 describes integrated data from the quantitative and qualitative analyses. Using healthcare providers as a health information source was highly endorsed by AI women (78%) but was significantly associated with high health literacy but only at the bivariate level (OR=2.76, $p=0.01$). Using the church as a source of health information received a lower endorsement rate (16%) by AI women, but was significantly associated with health literacy (OR=0.42, $p=0.049$) though only at the bivariate level. Female friends, the internet, female family, TV/radio and social media were also identified as main sources of health information (46%, 45%, 32%, 22% and 17%, respectively) but bore no significant associations with health literacy levels.

Healthcare providers are a main and reliable source of health information

AI women who received health information from healthcare providers were almost three times more likely to have higher health literacy levels than those we did not use healthcare

providers as a health information source (OR: 2.76, $p=0.01$), but the relationship became non-significant after controlling for covariates. Throughout the narratives, participants in both the high and low health literacy groups revealed that they get health information primarily from healthcare providers. The participants went further to describe how the knowledge and expertise of healthcare providers made them a more credible source of health information than other sources such as the Internet or people in their network:

“One that I found useful was actually the physician... I asked her if I was eligible for Gardasil [Note. A vaccine approved for the prevention of infections caused by human papillomavirus (HPV)] to prevent HPV. So, I asked her about it, and she explained it so well. She also told me that at the time, I wasn’t eligible because I was older than 26. Great information. I feel like if I had looked at the information on Google it wouldn’t be the same. She presented the information to me because it related to me.” (college educated, 27 years, high health literacy).

“Let me say, I don’t concentrate on the one I get from people, but I go directly to the ones from doctor because I know that before he says anything, he is right at the point.” (less than high school, 63 years, low health literacy)

Ethnic church negatively influences health literacy

Aside from the ethnic church (16%) being the least endorsed source of health information, AI women who sought health information from the church were 58% less likely to have higher health literacy than those who used the church as a health information source (OR: 0.42, $p<0.05$), though only at the bivariate level. Interview participants stated that while the church provides social support for AI women, diseases such as cancer are highly stigmatized within the African immigrant community and are often not discussed in the church:

“When it comes to church, the church gathers them [AI women] around... I feel like it's hard to get our people to do things unless it's after church they are already there... People don't really share that they have any cancer because of the negative connotation. You have to find that out for yourself and even that they don't go into details. They just tell you to remember them in prayers. We hardly...well, in my opinion it's a hush hush. We don't share such information...they don't even give you the chance to even talk about it” (college educated, 40 years, high health literacy)

Female friends/family personal experiences make health information relatable

AI women, irrespective of their health literacy levels, sought a wide array of health information (e.g. Pap testing, fertility, contraceptive use, disease symptoms) from female in their social circles. Some participants reported that hearing about their female family and friends' past experiences made the health information they received more relatable. Other participants stated that they sought health information from female family and friends because it was more convenient, and it gave them the opportunity to openly discuss their female health concerns:

"Sometimes I feel information from friends are a little more credible. Especially when someone has been through it or knows somebody that has been through it." (college educated, 27 years, high health literacy)

"I remember when I was going through severe pain due to my menstrual cycle, and I went to the hospital...the only thing that can make this pain go is having a birth control pill. As I was taking it, I had this kind of different feelings, different signs, so I was like, what's going on. Then when I asked to my siblings, they were like, oh they know people like that who was taking that kind of medication...this kind of result you get which was the same thing I was getting" (high school graduate, 28 years, low health literacy)

Internet, television, and social media as health information sources do not influence health literacy in AI women

The multivariate analyses showed no significant associations among the internet, television, and social media as health information sources and AI women's health literacy. The qualitative interviews also supported the trend and showed that use of these sources was not limited to a particular health literacy group though younger women tended to talk more about social media, whereas older women focused their discussion on television and the Internet (YouTube):

"...I am not a person who watches TV but when I watch TV, I want to look for things like health...those types of things. That's where I get my health information from." (vocational school, 57 years, low health literacy)

"YouTube, the recent one I got from YouTube was that on this blood pressure, I saw one... I forgot the man's name; he was talking about the blood pressure medication. He said we should not only depend on medication because it has side effects. What he said was that we should also look at the natural plants. That we can be taking so that it helps to at least, it helps in our body" (less than high school, 63 years, low health literacy)

I am a technology person. I read a lot of social media like Facebook... When I'm feeling something, I make sure I read to keep me informed about health. (college educated, 31 years, high health literacy)

Types of health information

Verbally transmitted health information was the most frequently used type of health information (80%) among AI women and was also significantly associated with higher health literacy levels (OR=2.29, p=0.039). AI women who received health information verbally were 5 times more likely to report higher health literacy levels than those who did not receive health information in verbal form, even after controlling for covariates (aOR: 5.51, p=0.01). Having health information presented in written form or using visual aids (pictures and videos) were rated as the second and third frequently used types of health information (66% and 43%) respectively, despite their nonsignificant associations with health literacy.

Verbal exchange improves health literacy

Verbal exchange was a prominent form of health information noted in the AI sample. In addition to majority of survey participants indicating that they primarily received health information in verbal form, when asked about preferable means of health information delivery, most high health literate AI women stated that they liked to receive health information through verbal exchange:

"Sometimes in our female groups we always have health talks and how to take care of the home. We usually have people come and give us a talk on topics they feel are important." (college educated, 54 years, high health literacy)

Some participants also described the success of previous health programs within African immigrant communities and suggested that future interventions that target AI women incorporate verbal communication:

“Back home because of the level of education, a lot of things are presented to women in form of songs when they come from the clinic. When women come to the clinic, they sing your song, so they stick with them. And then help them remember those things...Here, you are not allowed to have that kind of support. Back home, experience is good. Those who go to the hospital, apart from the medication, they have support.... Create a peer group and have friends to create the peer group to go out there... Make sure that people get screening like you want them to get. You use peer groups who are not experts like you. Support the women group. Because here, a lot of people have the opportunity more than those back home. So, you have to be able to stretch arms to those people that really need this kind of help. Information is very important. Once people are informed, it can do a lot.” (vocational school, 57 years, low health literacy)

Health information presented in written and visual aid forms do not influence health literacy

Having health information presented in written text (66%) was associated with almost a 3 times likelihood of higher health literacy (OR: 2.96, $p < 0.01$), but the relationship was no longer significant when we controlled for covariates. Using visual aids (43%) to present health information was not associated with health literacy. Throughout the qualitative narratives, high health literate participants mentioned that they often had information presented to them in written form (i.e. pamphlets, journals, magazines). While low health literate participants identified low English proficiency as a barrier to effective provider-patient communication, and suggested that health information be presented using visual aids (i.e. pictures, videos):

“They have a lot of pamphlets, and a lot of books about it in their offices. They gave me one of it to read” (college educated, 31 years, high health literacy)

“I didn’t know what they talk about, but I tell them that I will sign anything they tell me to sign. That time I did not understand English, so I did not know what the doctor talk about... If they show you picture, you can compare to what they tell you. If they just tell you, you can’t understand. If they show me the picture then I know part of the body the doctor is talking about” (less than high school, 53 years, low health literacy)

DISCUSSION

Using a mixed-methods design, we performed a secondary analysis of data to explore how various sources (family, family/relatives, church, TV/radio, internet, social media, healthcare provider) and types (verbal, written text, pictures) of health information influence health literacy among AI women living in the U.S. Past studies have focused primarily on how

sociodemographic factors influence health literacy levels [17], [27], and have mostly included Chinese and Hispanic immigrants [15]–[17].

Results from the study survey showed that AI women primarily sought health information from healthcare providers, female friends/relatives, and the internet. However, we found no significant associations between the various sources of health information and health literacy after controlling for all covariates. The qualitative interviews revealed that AI women, irrespective of their health literacy levels, rated healthcare providers as the most credible health information source, corroborating findings from a national report which showed that immigrants (i.e. Hispanics) preferred health information from healthcare providers to other sources (radio, television, internet) [46]. The qualitative interviews also revealed that hearing about the past experiences of other females made the health information they received more relatable. The results support the need to inform providers on culturally appropriate and effective ways to engage AI women in a healthcare setting. Future studies that aim to improve reproductive health behaviors such as breast and cervical cancer screening among AI women in the U.S. should also focus on improving communication and information sharing within participants' social networks (female friends/family). Peer education positively influenced Ghanaian and South African women's likelihood of changing a health behavior because of the cultural similarities that exist between the peer educator and recipient of the health information [31], [47].

Ethnic churches provide social support and a sense of social cohesion for many immigrant communities [48], [49], but only a small proportion (16%) of our study participants reported that they received health information from the church. Our quantitative survey results also showed that using the church as a health information source negatively influenced AI women's health literacy in relation to cancer screening. In the qualitative interviews, participants

revealed that cancer is stigmatized within AI communities, and cancer screening is not openly discussed at church or other social gatherings. Similar findings were reported in two South African studies where clergy reported that they did not offer HIV prevention and reproductive programs to their congregation due to the fear and stigma associated with these health topics[50], [51]. Future church-based interventions designed to improve AI women's health literacy and cancer screening behaviors should also address the stigma and fatalistic beliefs surrounding cancer [52], [53].

In our study, AI women who had health information presented to them in verbal form, were 5 times more likely to report higher health literacy levels. A possible explanation might be that, AI women who receive health information through verbal exchange have a greater likelihood to understand, retain and use that knowledge to make appropriate health decisions. A similar finding was noted in a study of African American and Latino adults [24] where high health literate individuals were more likely to process (i.e., remember) health information they verbally discussed with healthcare providers. The majority of our study participants were originally from West and East Africa, where cultures are traditionally oral, and most cultural beliefs and health information are shared through verbal exchange [54]. When presenting health materials to a culturally unique population such as AIs, it is important to ensure that the information is presented in a culturally relevant manner so it captures the attention and addresses the health needs of the population [47], [55]. Our findings suggest that health literacy-focused interventions that use verbal exchange strategies to communicate health information, would be culturally appropriate, and have the potential to improve health literacy among AI women.

In our study, nearly a half of AI women in the sample reported using the internet (45%) to address their health needs. Use of social media (17%) was less frequent but the qualitative

interviews further revealed that regardless of health literacy levels, younger AI women used social media (WhatsApp and Facebook) to communicate and disseminate women's health information (cancer screening, fertility, diet and exercise) within their social networks. The internet and social media are new, yet rapidly diffusing information retrieval and communication platforms, particularly among immigrants [56]. Previous studies have shown that most adults in the U.S., irrespective of their health literacy levels, looked for health information on the internet and on social media [56]–[58]. Our findings suggest that disseminating health information online via internet and social media could be a potentially effective strategy to address the health needs of AI women. However, all participants were unable to describe how they determined the quality and accuracy of online health information, indicating that AI women could be at risk of encountering and acting on inaccurate and potentially harmful health information they find online. Further studies are needed to inform the development of effective strategies to improve AI women's ability to critically evaluate the credibility of online health information.

STUDY LIMITATIONS

For the quantitative phase of the study, we used a relatively small, convenience sample of 167 AI women who were predominantly middle-aged (mean age: 40 years), college educated (68%) with high English proficiency (77%), which limits the generalizability of our findings. In addition, our quantitative results showed no significant associations among the various sources of health information and health literacy, suggesting that our study may have been underpowered for the multiple adjusted analyses. Nevertheless, this study used a mixed-methods design, which allowed us to better understand the intricate interplay between various sources and types of health information and health literacy in AI women.

CONCLUSION

Cultural beliefs and attitudes influence health literacy, and are key to how individuals communicate, understand and use health information[4], [24]. Our primary finding that verbal information exchange informs health literacy levels among AI women identifies a critical gap in health literacy knowledge, and lays the foundation for examining the impact of verbal health information exchange on health outcomes among culturally and linguistically diverse immigrant populations in the U.S. Future research to gain a better understanding of the role of verbal information exchange on health literacy levels, may allow for effective provider-patient communication, particularly among AIs whose cultural tradition also promotes health information exchange through verbal communication. Future research should focus on the development of culturally appropriate internet and social media-based interventions to address the health behaviors and health needs of AI women.

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Table 1: Description of sample for quantitative phase of the study

Characteristic	Overall (N=167)
Age, y mean (SD)	40.9 (12.25)
Range	22-65
Income (n, %)	
Low	84 (50)
High	83 (50)
Education (n, %)	
< College	53 (32)
College educated	114 (68)
English proficiency score mean (SD)	22.69 (3.86)
Primary care (n, %)	
Yes	123 (74)
No	44 (26)
⁺⁺Sources of health information (n, %)	
Female friends	76 (46)
Female family	53 (32)
Church	26 (16)
TV/Radio	36 (22)
Internet	76 (45)
Social media	28 (17)
Healthcare provider	131 (78)
⁺⁺Types of health information (n, %)	
Verbal	134 (80)
Written text	108 (66)
Pictures	72 (43)
Health Literacy (n, %)	
Low	79 (47)
High	88 (53)

⁺⁺Do not add to 100% because participants marked all options that applied

Table 2: Description of participants interviewed for qualitative phase of the study (N=20)

Characteristics	High health literacy (n=15)	Low health literacy (n=5)
Age, y mean (SD)	37.3 (10.29)	45.4 (15.37)
Age range	24-61	26-63
Education (n, %)		
<HS	1(7)	2 (40)
HS graduate	--	2 (40)
Vocational school	1 (7)	1 (20)
College	13 (86)	--
English Proficiency (n, %)		
Low	--	2 (40)
High	15(100)	3 (60)

HS: High school

Table 3: How sources and types of health information influence information sharing and health literacy among AI women

Information source/type (%)	Unadjusted OR (p-value)	*Adjusted OR (p-value)	Quote(s)
Healthcare providers as a main source of health information			
Healthcare provider (78%)			<i>"One that I found useful was actually the physician...I asked her if I was eligible for Gardasil to prevent HPV. So, I asked her about it, and she explained it so well. She also told me that at the time, I wasn't eligible because I was older than 26. Great information. I feel like if I had looked at the information on Google it wouldn't be the same. She presented the information to me because it related to me." (college educated, 27 years, high health literacy)</i> <i>"If I had any questions about my health, I'm going to the doctor. If I'm sick, I go to the doctor. " (vocational school, 57 years, low health literacy)</i>
No	Ref	Ref	
Yes	2.76 (0.039)	2.51 (0.069)	
Female friends/family personal experiences make health information relatable			
Friends (46%)			<i>"Sometimes I feel sources from friends are a little more credible. Especially when someone has been through it or knows somebody that has been through it." (college educated, 27 years, high health literacy)</i>
No	Ref	Ref	
Yes	0.90 (0.757)	1.17 (0.785)	
Family (32%)			<i>"I remember when I was going through severe pain due to my menstrual cycle, and I went to the hospital...the only thing that can make this pain go is having a birth control pill. As I was taking it, I had this kind of different feelings, different signs, so I was like, what's going on. Then when I asked to my siblings, they were like, oh they know people like that who was taking that kind of medication...this kind of result you get which was the same thing I was getting" (high school graduate, 28 years, low health literacy)</i>
No	Ref	Ref	
Yes	0.68 (0.208)	0.85 (0.759)	
Internet, television and social media as information sources do not influence health literacy among AI women			
Internet (45%)			<i>"...I am not a person who watches TV but when I watch TV, I want to look for things like health...those types of things. That's where I get my health information from" (vocational school, 57 years, low health literacy)</i>
No	Ref	Ref	
Yes	1.62 (0.124)	0.63 (0.330)	
TV (22%)			<i>"I am a technology person. I read a lot of social media like Facebook... When I'm feeling something, I make sure I read to keep me informed about health" (college educated, 31 years, high health literacy)</i>
No	Ref	Ref	
Yes	0.72 (0.991)	1.45 (0.544)	
Social media (17%)			<i>"YouTube, the recent one I got from YouTube was that on this blood pressure, I saw one... I forgot the man's name; he was talking about the blood pressure medication. He said we should not only depend on medication because it has side effects. What he said was that we should also look at the natural plants. That we can be taking so that it helps to at least, it helps in our body" (less than high school, 63years, low health literacy)</i>
No	Ref	Ref	
Yes	1.04 (0.916)	1.63 (0.453)	
Church is the least endorsed source of health information			

Church (16%)				<p><i>“When it comes to church, the church gathers them [AI women] around... I feel like it's hard to get our people to do things unless it's after church they are already there... People don't really share that they have any cancer because of the negative connotation. You have to find that out for yourself and even that they don't go into details. They just tell you to remember them in prayers. We hardly...well, in my opinion it's a hush hush. We don't share such information...they don't even give you the chance to even talk about it” (college educated, 40 years, high health literacy)</i></p>
No	Ref	Ref		
Yes	0.42 (0.049)	0.66 (0.582)		
Verbal exchange improves health literacy				
Verbal (80%)				<p><i>“Sometimes in our female groups we always have health talks and how to take care of the home. We usually have people come and give us a talk on topics they feel are important.” (college educated, 54 years, high health literacy)</i></p> <p><i>“Back home because of the level of education, a lot of things are presented to women in form of songs when they come from the clinic. When women come to the clinic, they sing your song, so they stick with them. And then help them remember those things...Here, you are not allowed to have that kind of support. Back home, experience is good. Those who go to the hospital, apart from the medication, they have support.... Create a peer group and have friends to create the peer group to go out there... Make sure that people get screening like you want them to get. You use peer groups who are not experts like you. Support the women group. Because here, a lot of people have the opportunity more than those back home. So, you have to be able to stretch arms to those people that really need this this kind of help. Information is very important. Once people are informed, it can do a lot.” (vocational school, 57 years, low health literacy)</i></p>
No	Ref	Ref		
Yes	2.29 (0.039)	5.51 (0.005)		
Health information presented in written and visual aid forms do not influence health literacy				
Written (66%)				<p><i>“They have a lot of pamphlets, and a lot of books about it in their offices. They gave me one of it to read” (college educated, 31 years, high health literacy)</i></p> <p><i>“I didn't know what they talk about, but I tell them that I will sign anything they tell me to sign. That time I did not understand English, so I did not know what the doctor talk about... If they show you picture, you can compare to what they tell you. If they just tell you, you can't understand. If they show me the picture then I know part of the body the doctor is talking about” (less than high school, 53 years, low health literacy)</i></p>
No	Ref	Ref		
Yes	2.96 (0.001)	2.51 (0.091)		
Visual aids (43%)				
No	Ref	Ref		
Yes	0.72 (0.985)	0.72 (0.569)		

OR: Odds Ratio

*Controlled for age, income, education, English proficiency, access to primary care

Appendix 1: Interview Guide

<p>Sources of health information</p>	<p>Where do you usually get women's health information?</p> <p>Do you think the source of the information determines its usefulness?</p> <p>Probe: Does the usefulness of the information change if you get it from a doctor, female family/friend, pastor/head of women's ministries, daughter? Tell me more</p> <p>Tell me about a recent encounter with your doctor where you found the information useful, can you share that information with me?</p> <p>**If no recent doctor encounter, then ask about most recent encounter (female family/friends, daughter, pastor/church) where they received women's health information**</p> <p>If you had any questions about your health, who would you talk to, and why?</p>
<p>Type of health information</p>	<p>Describe a women's reproductive health message that you found useful</p> <p>How was the message presented to you?</p> <p>Who presented the information to you?</p> <p>Why did you find it useful?</p> <p>If you had the chance to teach other women about cervical cancer, what would you tell them? What about a Pap test?</p> <p>Probe: What will be the best way to educate other women in your social circles?</p> <p>How should the information be presented?</p>

CHAPTER 7

Summary of Findings

Limited health literacy is a major barrier to cancer prevention behaviors—particularly among underserved racial/ethnic minority populations such as African immigrant women. Among African immigrant women, cancer is diagnosed at a significantly later stage, and they are also among the least likely ethnic/racial groups to receive cervical cancer screening compared to African Americans, Asian and Hispanic immigrants. Research evidence shows that sources and types of health information have potential to shape health literacy levels and inform the Pap testing behaviors among AI women. However, how health literacy, sources and types of health information along with cultural and psychosocial correlates impact the Pap testing behaviors of AI women remains unknown.

An explanatory mixed-methods study was conducted to understand how sources and types of health information exchange impact health literacy and ultimately, Pap testing behaviors among AI women living in the US. An adapted Health Literacy Skills Framework was used to guide the study. A total sample of 167 African immigrant women (in-person: n=91, online=76) participated in the quantitative phase of the study. A purposive sample of 20 in-person participants were interviewed for the qualitative phase

First, we hypothesized that AI women who use multiple sources and types of health information will have higher health literacy levels than AI women who use a single source and type of health information. A majority of participants indicated that they used multiple (two or more) sources (65%) and types (57%) of health information. Using multiple sources (aOR: 0.97, p=0.958) and types (aOR: 2.56, p=0.056) of health information were not significantly associated with high health literacy after controlling for all covariates.

Second, we examined the association among health literacy, psychosocial (cancer knowledge, self-efficacy, decisional balance, cultural beliefs/attitudes) correlates and Pap testing among AI women. We hypothesized that higher health literacy, higher cancer knowledge, higher self-efficacy, higher decisional balance and positive cultural beliefs would be associated with Pap testing after controlling for all covariates. Most participants (71%) had received a Pap test in the past. Our results showed that AI women with negative attitudes towards Pap testing, were 83% less likely to report the receipt of a Pap test in the past (aOR: 0.17, $p=0.015$). AI women with high self-efficacy were 9 times more likely to receive a Pap test (aOR: 9.38, $p=0.003$). High health literacy and high decisional balance were not associated with Pap testing after controlling for covariates. Among AI women, culture plays a critical role in informing and shaping cancer screening behaviors regardless of other known social determinants of health such as education, healthcare access and English proficiency. The development and use of culturally tailored programs to address the cancer health needs of AI women could be an effective strategy. We also performed an exploratory analysis of the association between multiple sources/types of health information and Pap testing. Our results showed that using multiple sources of health information (aOR:0.11, $p=0.006$), but not types of health information (aOR: 1.57, $p=0.575$) was significantly associated with Pap testing. This finding indicates that disseminating health information through various sources has the potential to promote Pap testing among AI women. Our results also highlight the need for further methodologically rigorous studies that utilize both quantitative and qualitative research designs to explore AI women's preferred sources/types of health information, and how their perceived usefulness influence AI women's health literacy levels and ultimately their health behaviors.

Using a mixed-methods design, we performed a secondary analysis of data to explore how various sources (family, family/relatives, church, TV/radio, internet, social media, healthcare provider) and types (verbal, written text, pictures) of health information influence health literacy among AI women living in the U.S. Results from the study survey showed that AI women primarily sought health information from healthcare providers (78%), female friends (46%) and internet (45%). However, we found no significant associations between the various sources of health information and health literacy after controlling for all covariates. The qualitative interviews revealed that AI women, irrespective of their health literacy levels, rated healthcare providers as the most credible health information source. The qualitative interviews also revealed that hearing about the past experiences of other females made the health information they received more relatable. The results support the need to inform providers on culturally appropriate and effective ways to engage AI women in a healthcare setting. Using peer educators (female friends/family) and incorporating verbal communication into public health interventions could be an effective strategy to promote positive health behaviors among AI women. When presenting health information to AI women in the clinical setting, healthcare providers should also consider verbal communication rather than written forms.

Ethnic churches provide social support and a sense of social cohesion for many immigrant communities, but only a small proportion (16%) of our study participants reported that they received health information from the church, which also negatively influenced their health literacy in relation to cancer screening. During the qualitative interviews, participants also revealed that cancer is stigmatized within AI communities and not openly discussed at social gatherings. When developing church-based interventions to improve the cancer screening

behaviors of AI women, researchers should also consider addressing stigma and AI women's fatalistic beliefs surrounding cancer.

AI women who had health information presented to them in verbal form, were 5 times more likely to report higher health literacy levels (aOR: 5.51, $p=0.005$). Our primary finding that verbal information exchange informs health literacy levels among AI women identifies a critical gap in health literacy knowledge, and lays the foundation for examining the impact of verbal health information exchange on health outcomes among culturally and linguistically diverse immigrant populations in the U.S. Future research to gain a better understanding of the role of verbal information exchange on health literacy levels, may allow for effective provider-patient communication, particularly among AIs whose cultural tradition also promotes health information exchange through verbal communication. Future research should focus on the development of culturally appropriate internet and social media-based interventions to address the health behaviors and health needs of AI women.

The internet and social media are new, yet rapidly diffusing information retrieval and communication platforms, particularly among immigrants. Nearly half of AI women in the sample reported using the internet (45%) to address their health needs. Use of social media (17%) was less frequent but the qualitative interviews further revealed that regardless of health literacy levels, younger AI women used social media (WhatsApp and Facebook) to communicate and disseminate women's health information (cancer screening, fertility, diet and exercise) within their social networks. Our findings suggest that disseminating health information online via internet and social media could be a potentially effective strategy to address the health needs of AI women. However, all participants were unable to describe how they determined the quality and accuracy of online health information, indicating that AI women could be at risk of

encountering and acting on inaccurate and potentially harmful health information they find online. Further studies are needed to inform the development of effective strategies to improve AI women's ability to critically evaluate the credibility of online health information.

Contribution to Related Field of Science

In conclusion, the findings of this study can inform future studies to address the gap in knowledge regarding the role that healthcare providers and cultural beliefs play in informing the health behaviors of African immigrant women. This study also has the potential to serve as a foundation for addressing health disparities by informing the design of culturally tailored, health literacy focused interventions using innovative strategies such as online recruitment, to address cancer screening among African immigrant women. Aggregating research data on various African-descent populations (i.e. African immigrants, African Americans and Afro-Caribbean immigrants) into the “Black” racial category without accounting for cultural differences that exist amongst these groups may result in flawed research findings and erroneous conclusions. Improving the cancer screening behaviors and overall health of African immigrant women calls for various policy changes. First, national data such as the National Health Interview Survey(NHIS) and National Health and Nutrition Examination Survey(NHANES), should include a diverse sample of African immigrants (different nationalities) sampled from U.S. states where a large group of African immigrants reside (e.g. Washington-D.C, New York, California, Texas, Maryland, Virginia, New Jersey and Minnesota).

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1. **Cudjoe, J.**, Turkson-Ocran, R.-A., Ezeigwe, A. K., Commodore-Mensah, Y., Nkimbeng, M., & Han, H.-R. (2019). Recruiting African immigrant women for community-based cancer prevention studies: Lessons learned from the AfroPap study. *Journal of Community Health*. May 17.
2. Han, H.-R., Kim, K., **Cudjoe, J.**, & Kim, M. T. (2019). Familiarity, Navigation, and Comprehension: Key Dimensions of Health Literacy in Pap Test Use among Korean American Women. *Journal of Health Communication*, May; 2:1–7.
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9. Hamilton JB, Worthy VC, Kurtz MJ, **Cudjoe J**, Johnstone PA. (2016) Using religious songs as an integrative and complementary therapy for the management of psychological symptoms among African American cancer survivors. *Cancer Nursing*. Nov/Dec;39(6):488-494.
10. Commodore-Mensah Y, Sampah M, Berko C, **Cudjoe J**, Abu-Bonsrah N, Obisesan O, Agyemang C, Adeyemo A, Himmelfarb CD. (2016). The Afro-Cardiac Study: Cardiovascular disease risk and acculturation in West African immigrants in the United States: Rationale and study design. *Journal of Immigrant and Minority Health*. Dec;18(6):1301-1308.

In Review

1. **Cudjoe, J.**, Turkson-Ocran, R.-A., Ezeigwe, A. K., Commodore-Mensah, Y., Nkimbeng, M., & Han, H.R. (2019). Understanding the Pap testing behaviors of African immigrant women living in developed countries. *Journal of Immigrant and Minority Health*

2. Nkimbeng, M., Turskion-Ocran, R., Thorpe, R., Szanton, R., **Cudjoe, J.**, Commodore-Mensah, Y. (2019). Prevalence of functional limitations among foreign and US-born Black older adults: 2010-2016 National Health Interview Surveys. *Ethnicity & Health*.
3. Jin S, **Cudjoe J**, Peay A, Han H.R. (2019). Understanding barriers and facilitators of Pap testing among women living with HIV: a focus group study. *Journal of the Association of Nurses in AIDS Care*.
4. **Cudjoe, J**, Turskion-Ocran, R, Sullivan, N, Pandian, V. (2019). To review or not to review? Exam review strategies for nursing students. *Journal of Nursing Education*.

Presentations

1. **Cudjoe, J.**, Turkson-Ocran, R.-A., Ezeigwe, A. K., Commodore-Mensah, Y., Nkimbeng, M., & Han, H.R. Understanding the Pap testing behaviors of African immigrant women living in developed countries [accepted]. American Public Health Association; 2019 November; Philadelphia, PA, USA.
2. **Cudjoe, J.**, Turkson-Ocran, R.-A., Ezeigwe, A. K., Commodore-Mensah, Y., Nkimbeng, M., & Han, H.-R. Recruiting African immigrant women for community-based, cancer prevention studies: Lessons learned from the AfroPap study. Johns Hopkins University Diversity and Inclusion Conference; 2019 May; Baltimore, Maryland
3. Han H, Kim K, **Cudjoe J**, Kim M. Critical dimensions of cancer literacy among Korean immigrant women in the United States. Sigma Theta Tau International Nursing Research Congress; 2019 July; Calgary, Alberta, Canada. [submitted]
4. **Cudjoe, J**, Delva S, Cajita M, Han H. Empirically tested health literacy frameworks; 2018 October; Washington D.C, USA.
5. **Cudjoe, J**, Turkson-Ocran, R, Sullivan, N, Pandian, V. To review or not to review? Exam review strategies for nursing students. Johns Hopkins School of Medicine Education Conference; 2018 April; Baltimore, MD, USA.
6. Lemberg J, Iyer J, **Cudjoe J**, Han H. Recruitment of HIV positive women in a community partnered randomized trial for cervical cancer prevention. American Public Health Association Annual Meeting & Expo; 2017 November; Atlanta, Georgia, USA.
7. Nkimbeng, M, **Cudjoe, J**, Turkson-Ocran, R, Szanton, S. Prevalence and correlates of disability in older immigrants in the United States: A systematic review. American Public Health Association Annual Meeting & Expo; 2017 November; Atlanta, Georgia, USA.
8. Galusha K, Roche O, Brooks K, **Cudjoe J**, Sharps P, Farley J, Han H. Depression and stigma as barriers to optimal cervical cancer screening among HIV positive women. American Public Health Association Annual Meeting & Expo; 2017 November; Atlanta, Georgia, USA.
9. **Cudjoe J**, Han H. A descriptive analysis of the health literacy levels of HIV infected women in Baltimore,

Maryland. International Conference on Communication in Healthcare & Health Literacy Annual Research Conference; 2017 October; Baltimore, Maryland, USA

10. Han H, Xu A, Waligora K, Okoye S, **Cudjoe J**, Himmerlfarb DC. Progress in Stakeholder Engaged Research Forum: Best Practices and Key Lessons Learned. Advancing Community Engaged Research Conference; 2017 September; Washington D.C., USA.
11. Commodore-Mensah Y, **Cudjoe J**, Himmelfarb DC. Church-based recruitment of African immigrants: Evidence and Lessons Learned from the “Afro-Cardiac Study”. Sigma Theta Tau International 28th International Nursing Research Conference; 2017 July; Dublin, Ireland.
12. Gray, T, **Cudjoe J**, Han H, Wenzel J, Thorpe R, Murphy J. Have you checked? Disparities in cancer screening practices among minority populations. American Association for Cancer Research; 2017 April, Washington D.C., USA.
13. **Cudjoe J**, Nkimben M, Turkson-Ocran R. The determinants of breast and cervical cancer screening behaviors of African immigrant women living in industrialized countries: a critical literature review. International Council on Women’s Health Issues; 2016 November; Baltimore, MD, USA.
14. **Cudjoe J**. A comparative analysis of cervical cancer screening in African immigrant, African American and Afro-Caribbean women in the 2010-2014 National Health Interview Surveys. United States Conference on African Immigrant & Refugee Health; 2016 September; Queens, New York, USA.
15. Commodore-Mensah, Y., Berko, C.A., Sampah, M.E., **Cudjoe, J.**, Himmelfarb, C.D. The afro-cardiac study: identifies high burden of cardiovascular disease risk in West African immigrants in the United States. American Heart Association Epi|Lifestyle; 2015 October, Baltimore, MD, USA.

RESEARCH

Year	Position	Study, Institution, Sponsor
2017-present	Principal Investigator (Disseration)	<i>The Pap Testing Behaviors of African Immigrant Women Study</i> , Johns Hopkins School of Nursing, National Institute of Health, NCI (1F31CA221096-01). \$125,463
2017-Present	Graduate Research Associate	<i>African Immigrant Health Study</i> , Johns Hopkins School of Nursing, Johns Hopkins Clinical Research Scholars Program (5KL2TR0001077-05) PI: Yvonne Commodore-Mensah, RN, PhD
2017-Present	Research Coordinator	<i>Health Literacy-Focused Intervention to Promote Pap Testing among Women Living with HIV</i> , Johns Hopkins School of Nursing, Dorothy Evans Lyne Fund. \$10,000

2016-2017	Research Coordinator	<i>Community Based Cervical Cancer Prevention and Health Education Study</i> , Johns Hopkins School of Nursing, National Institutes of Health, NIAID (P30A1094189). \$50,000 PI: Hae-Ra Han, PhD
2013-2014	Undergraduate Research Assistant	<i>The Afro-Cardiac Study</i> , Johns Hopkins School of Nursing, Center for Excellence for Cardiovascular Health (1P30NR011409). \$6,000 PI: Yvonne Commodore Mensah
2013-2014	Team Leader	<i>The Traffic Light Study (Quality Improvement Project)</i> , MedStar Washington Hospital Center, Washington, D.C
2009	Research Intern	<i>The hypoglycemic effects of Indigofera arrecta</i> , Research Experience for Undergraduates Program (REU); University of Cape Coast, Ghana
2008	Research Intern	<i>The antimicrobial activity of chemokines on Francisella tularensis</i> , Summer Research Internship Program (SRIP); University of Virginia, Charlottesville, Virginia

HONORS AND AWARDS

Year	Award
2018	National Cancer Institute, Summer Cancer Prevention Program (Invited Scholar) Johns Hopkins School of Nursing Dissertation Award American Cancer Society Doctoral Degree Scholarship in Nursing [Fundable Score: "Outstanding"]
2017-2018	Nursing Faculty of the Future Fellow, Johns Hopkins School of Nursing (Sponsor: Maryland Higher Education Commission)
2017-Present	National Cancer Institute, Pre-doctoral Training Award [1F31CA221096-01]
2017	Sigma Theta Tau International Research Award, Nu Beta Chapter, Johns Hopkins University

TL1 Pre-doctoral Clinical Research Training Program,
Johns Hopkins University

2016	Sigma Theta Tau International Honor Society of Nursing, Nu Beta Chapter, Johns Hopkins University (Invited Member)
2012	Best Nurse Led Project Award, MedStar Washington Hospital Center
2011	Robert Wood Johnson New Career in Nursing Scholarship, Johns Hopkins University
	Daniels Interprofessional Education Scholar Program (Invited Scholar), Johns Hopkins School of Nursing
2005-2009	Deans Gold Scholarship Award, Baylor University
	Dean's List, Baylor University

EDUCATIONAL ACTIVITIES

Spring 2019	NR 120.519.8101 Population Health Leadership, Graduate Teaching Fellow, 120 Students
Spring 2018	NR 120.519.8101 Population Health Leadership, Graduate Teaching Fellow, 69 Students
Fall 2017	NR. 120.516.0101 Integrated Clinical Management: Complex Health Alterations, Graduate Teaching Fellow, 84 students
2016-Present	Johns Hopkins Interprofessional Education Program, Facilitator
2011-2012	Tarrant County Community College, Computer Lab Coordinator

PROFESSIONAL ACITIVIES

Year	Position, Institution
2018-Present	Scientific Review Committee (Invited Member), AfreHealth Symposium, South Africa
2016-Present	Abstracts Subcommittee (Invited Member), International Cancer Education Conference
2013-2014	Nurse Preceptor, Medstar Washington Hospital Center

EDITORIAL ACTIVITIES

Manuscripts

Year	Position, Institution/Conference
2018-Present	Manuscript Reviewer, Journal of Immigrant and Minority Health
2017-Present	Manuscript Reviewer, Ethnicity & Health

Abstracts

Year	Position, Institution/Conference
2018-Present	Abstract Reviewer, AFREhealth Symposium Abstract Reviewer, American Public Health Association
2016-Present	Abstract Reviewer, International Cancer Education Conference

SERVICE ACTIVITIES

Year	Position, Institution/Conference
2016-Present	Outreach volunteer, African Women's Cancer Awareness Association, Maryland
2011	Nurse Assistant, Potomac Hospital (Emergency Room Department), Virginia